RIFLEMAN AND PISTOLMAN

By the same author

RIFLE AND GUN
SEWERAGE ENGINEERING
REGIONAL PLANNING
SURFACE DRAINAGE
SEWERAGE DESIGN AND SPECIFICATION
THE MUNICIPAL ENGINEER
THE WORK OF THE SANITARY ENGINEER
SEWAGE TREATMENT: DESIGN AND SPECIFICATION
A CODE FOR SEWERAGE PRACTICE
SURFACE-WATER SEWERAGE
BUILDING SANITATION

RIFLEMAN AND PISTOLMAN

By

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Rifle and Gun

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PREFACE

A MAN can learn to use a firearm and become a good shot by practice and by intelligent study of the reasons for his failures. But much of the interest in shooting is in the materials of the game, and every shooting man gains something from the knowledge of how his weapon works and how his ammunition performs. The knowledge may also save him from being involved in one of the accidents which occur from time to time but are fortunately singularly rare.

Then there is the choice of weapons, the fitting of sights and those minor alterations that assist shooting and add much interest to the game: there are the more unusual aspects of shooting, of which the return to the use of black powder and muzzle-loaders is of considerable interest.

On pages 135 to 146 I have set out a glossary of terms used; in this I have included a number of American equivalents, because their use in some instances is becoming current outside the United States. In endeavouring to make the glossary as complete as possible I have included the familiar as well as the less common terms, and for this I make no apology.

In *Rifle and Gun* I attempted to outline the whole field of target and sporting-rifle shooting and sport with the shotgun, dealing with the practical, technical and legal aspects. The present book is confined to rifled arms: and it is more personal, for while of necessity it includes the elementary principles of ballistics, it is largely concerned with experience of weapons and equipment.

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Purley, Surrey L. B. ESCRITT

RIFLEMAN AND PISTOLMAN

Chapter I

My first pistol—The appeal of shooting—Weapons of the amateur shooter—First steps—Legal requirements—How and how not to get Firearm Certificate—The Firearms Act, 1937, *and another Act which is not so wise*

As a work of art my first pistol was a failure. It was also what, in these days, would be called "an illicit firearm". It was made from part of an old gas-burner bound by a wire to a bent metal frame. It was charged with home-made powder and primed with a pink-paper cap stuck in position with dripping! The hammer was taken from a halfpenny pistol—and worked remarkably well. Fortunately my home-made powder, as might be expected, lacked pep.

Not long after this first essay into the field of gunmaking, I learnt that there were simpler and more effective ways of manufacturing hand-cannon and supplying them with ammunition. But these laudable activities did not meet with just that degree of support and encouragement that they deserved. In fact, I had to pack up the whole business or take the consequences!

These experiences of mine cannot have been uncommon among small boys ever since gunpowder became available to beg, borrow, steal or make. Richard Jefferies in *The Amateur Poacher* tells how his first gun was burnt so as to keep him out of trouble: but how, later, he met with better fortune and came by another and better gun that he was permitted to use. Many a fine shot of the present day first handled real lethal weapons in pursuit of game at about the age of ten. For guns have an appeal to the boyish imagination, an appeal which never altogether fades.

The arts of shooting also have their appeal, but in many different ways. Some of us find our happiest moments beginning when we break away from routine, don our country clothes and journey to one of our favourite stamping grounds; and reach culmination when, after a long and pleasantly fatiguing day, we subside into an armchair, with the whisky reassuringly close at hand.

Most of us do not see as much of the country as we would like and get too little opportunity for game shooting with either gun or rifle. But any town dweller who has the mind can keep in practice with the small-bore rifle or pistol at one or more of the three to four thousand clubs affiliated to the National Small-Bore Rifle Association. Pleasant evenings can be spent in serious endeavour to produce a "possible" on the match or practice card, interspersed with the relaxation of nattering with fellow rifle- or pistol-men in the club room. And then there are those glorious days at open meetings—in particular the N.S.R.A. week and the National Rifle Association fortnight, at Bisley—events that are held at the best time of the year, more often than not in perfect weather and in the most pleasant of surroundings.

Those of us who have had these experiences know well what they mean or are worth. But in writing this book I have in mind primarily the young fellow who is attracted by firearms but has as yet no real knowledge or experience of them. He it is that has most need of guidance, not only on the art of shooting but on the safe and right handling of weapons: on knowledge of the law relating to their employment: and on the etiquette of the rifle club and sporting field. These are matters which *must* be learnt first.

Riflemen have no technical snobbery. When you meet the hunting clique you talk about "pink" when you mean red, "grey" when you mean white, and "hounds" when you mean dogs—or you are an outcast. But if you are a rifleman, you can call your rifle a "gun", the barrel a "spout", the hand a "grip", or whatever you like. And you will always be welcome however unproficient you are, provided that you are well mannered and safe.

I have heard it said that many a sportsman, expert enough in bringing down birds, knows no more about his gun than that the bullets come out of the spout. And perhaps there is no need for him to know more, provided he continues to shoot straight and nothing goes wrong with the works. But this attitude of mind will not do for the competition-target man, who, in addition to constant practice and self-discipline, learns all he can of the technical means of improving his average. This is particularly true of those who are scientifically or mechanically minded, for the mechanism of firearms reached a high degree of perfection

during centuries of evolution and yet is still capable of improvement.

The weapons which are available to the amateur shooter are the target rifle and sporting rifle, among the former being classed military rifles used for target purposes: the single-shot pistol, the semi-automatic and the revolver: and sporting shotguns. Excluded are military weapons such as sub-machine guns and those pistols and rifles which continue to fire for so long as the trigger is held, and, in fact, all "prohibited weapons" for which firearm permits are not issued.

Anyone who carries a gun beyond the limits of his own house and garden—the "curtilage" as the lawyers say—even if it is only an air-gun, must have a gun licence, unless he is exempted. The exemption applies to members of approved rifle or pistol clubs which hold an exemption certificate. Such members may carry target rifles or pistols to or from their range, or any other range where they wish to compete, without holding a licence. But they have to have a gun licence if they wish to shoot rabbits or other vermin, or a game licence (which includes the right to carry a gun) if they wish to shoot game.

The gun licence and the game licence are merely taxes, and the forms may be obtained by anyone on application and payment at a post office. But before any rifle, or pistol, or any gun with a barrel of less than twenty inches length can be purchased, accepted as a gift, or even temporarily borrowed, a Firearm Certificate must be obtained. To obtain this, application must be made *in person* at the police station in the district where the applicant lives, a fee of five shillings paid, and a form filled in.

This is a matter on which you can easily go wrong. The law says that anyone who has not a criminal record is entitled to have firearms, if he has good reason for having them. But the police are naturally cautious, for they do not want all and sundry to use firearms about the countryside or even in their own backyards. And they are particularly anxious that all arms and stocks of ammunition be properly kept, so that there shall be as little danger as possible of their falling into wrong hands. Therefore they want to know the reasons why the arms are desired and where and how they will be used; and they will refuse to grant a certificate if they think the applicant has not good reason for wanting the weapons in question or cannot be trusted with them.

In the event of definite refusal to grant a certificate, an aggrieved individual can appeal in court, but it is much better to satisfy the police in the first place and get your certificate granted without having to resort to legal proceedings.

The Firearms Act is framed so as not to restrict from possession of arms and ammunition anyone who has good reason for having them; but the police sometimes have their own view as to what is good reason, and this view does not always coincide with that of public opinion or legal decision. For example, some years ago an experienced pistolman applied for a permit for a revolver for the defence of his personal property. The police turned down the application, as they had probably turned down previously many of the same kind. But the applicant took the case to court and the police were overruled.

I heard of another instance where a man said he wanted a ·455 revolver to shoot rabbits. Although this sounds like an unlikely weapon for the purpose, the application was very probably *bona fide*. Perhaps the gun was going cheap; and, anyhow, in America game shooting with revolvers is not at all uncommon—in fact, some patterns are actually made for that purpose. However, it failed to go through, and I doubt if it would have fared any better in a magistrates' court than it had with the police, for it is a bit too unusual an idea. The point is, you must have a good *and plausible* reason for acquiring the particular weapon you have in mind.

The reason that is most acceptable to the police for wanting a firearm is practice and competition at rifle or pistol clubs. This is no doubt because tens of thousands of riflemen are interested only in shooting at targets on officially approved ranges and are supported by the powerful associations that organize shooting. The associations have done what they can to ensure that target riflemen shall not be prevented from having their own weapons; and in this they have been helped by the War Department, for it is government policy that target shooting shall be encouraged because of its importance to national defence.

If you wish to obtain a weapon for target purposes, particularly a pistol, it is advisable that you should first become a member of a club approved for the use of the particular kind of weapon you want, for the police will probably ask what club or clubs you

Plate II. A marksman in shooting rig.

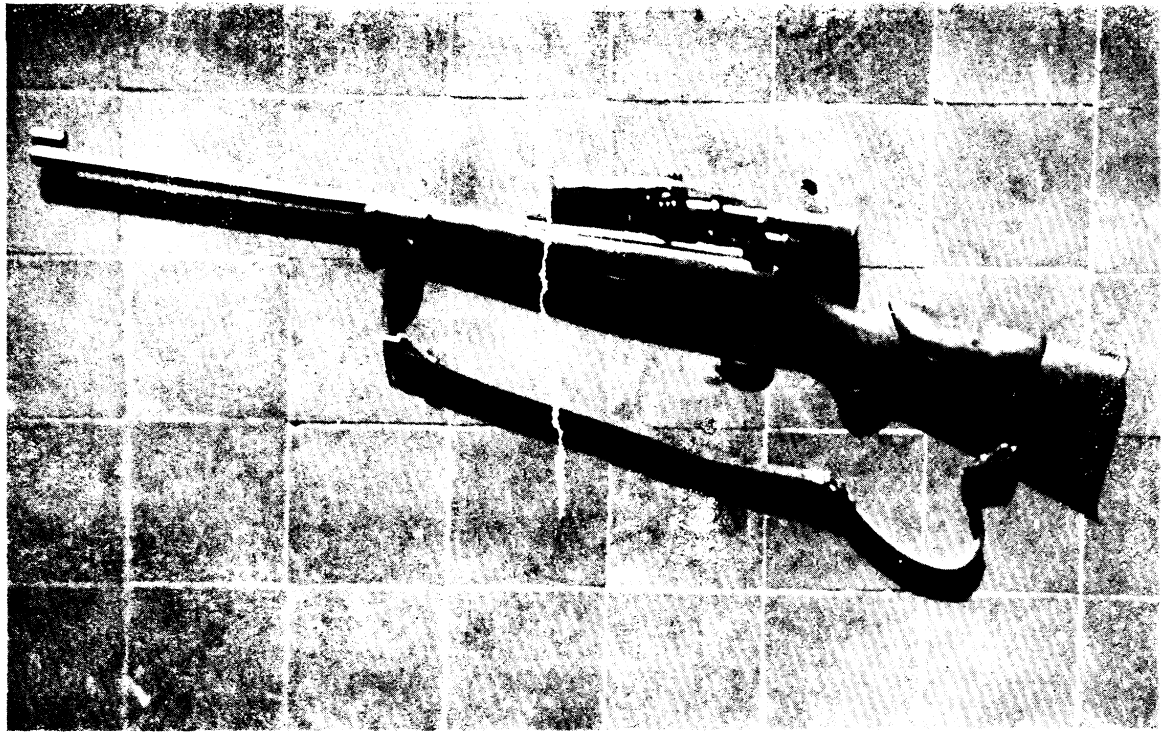


Plate VI. Zbrojovka Brno Mod. L .22 L. R. Rifle with Russian 4 × telescopic sight and plastic wood cheek piece before planing and polishing.

belong to. This applies to weapons of ·22 calibre taking rimfire cartridges, and those of military calibre that are used in clubs affiliated to the National Rifle Association. There are, of course, sporting rifles of many different calibres, and satisfactory reason for their possession is the pursuit of game or vermin for which the particular calibre would be suitable. For example, the ·22 rifle is used for rabbit shooting, but medium and big-game rifles can only reasonably be used abroad or for such purposes as deer stalking in the Highlands. When these are applied for, the police will want to know where they are to be used and may make enquiries in the localities mentioned as to whether shooting with the weapons specified would be safe and permissible. Even when I made my first application for a rifle to take the ·22 Hornet cartridge (which is the smallest of all the magnum rifles) I had to satisfy the police that the areas where I intended to use it were absolutely safe; and that, in addition to sporting purposes, the rifle would be used only on ranges approved for service rifles. The next time I bought a Hornet there was no query or delay: presumably reference was made to the previous entry on the file.

If you want a rifle for sport as well as for club shooting, you must say so, because it is now the usual practice of the police to endorse the certificate: "The rifle may be used on authorized ranges only", unless application has been made for its use elsewhere.

Two people may share the use of a firearm provided their certificates are suitably endorsed. My wife at one time had only one weapon on her Firearm Certificate, a small-bore rifle that had been fitted to her measurements. But it occurred to me that it would be convenient if she could lawfully use any of my sporting rifles, target rifles or pistols, as occasion might require. So we put in an application that the formidable collection listed on my certificate should also be included on hers "for practice, competition and sport".

I quite expected there might be a hitch or delay, but not a bit of it. In about a week, back came the certificate in the hands of a constable. There was only one thing that was wrong: my wife's original certificate held the restriction that the rifle was to be used on approved ranges only, for it was a target rifle. In error, this restriction had not been removed so, presumably, my wife

may not use any of the sporting rifles for sporting purposes. On the other hand, no mention was made of any restriction on the pistol or revolver, so she would not be committing an offence if she used them on rabbits.

A Firearm Certificate is required not only for rifled arms and the type of ammunition that is used in them but any component part of such a weapon; and any accessory adapted to diminish noise or flash—*i.e.* a silencer. You cannot buy without a certificate the barrel or the action of a rifle or a pistol, but dealers habitually sell sights, fore-ends and other bits and pieces not actually essential to the act of discharging shot without asking to see the Firearm Certificate. As far as sights are concerned, this has been confirmed in court. On the 23rd May, 1912, the Divisional Court allowed the appeal of the owner of a ·22 rifle who had been convicted by justices of unlawfully having in his possession a certain component part of a firearm—a telescopic sight. The justices had discharged him but directed him to have his certificate amended to include the sight. However, Lord Goddard, C.J., in delivering judgment at the appeal, said he could find no justification for the view that a telescopic sight required an amended certificate, and that the justices were clearly in the wrong.

The Firearms Acts, in particular the Act of 1917, have undoubtedly helped to make it difficult for dangerous weapons to get into the hands of irresponsible persons. But there were, and are, imperfections in these Acts which have had effects more far-reaching than is generally appreciated. The intention of the legislation was to prevent crime. But the housebreaker does not carry a rifle and would certainly not risk being seen in public with one. So why could not the restriction have been placed on pistols only? Moreover, a ·22 rifle is not as dangerous as the shotgun used at close quarters, for which no permit is required. As pointed out by Lord Cottisloe in his *The Englishman and the Rifle*, the Act of 1920 had far-reaching consequences which passed unobserved at the time. A very large reduction in the sale of ·22 rifles resulted, so that when, during the Second World War, it became necessary to raise the Local Defence Volunteers (Home Guard), there was almost an entire lack of ·22 rifles and ammunition for them to use in practice.

I think also that there would be benefit to all concerned if the

current Firearms Act could be modified or applied in a manner more effective for ensuring the registration of all arms and stocks of ammunition. At the present time there are large numbers of weapons and no small quantity of ammunition secretly held by persons who came by them legally or otherwise, and now do not know what to do with them. The reason that they are not surrendered in many instances is probably sheer neglect. But in other cases there are two operative factors: fear of the consequences of being in illegal possession, and distress at the thought of surrendering, for no return, a valuable arm which, we are led to believe, is destroyed when the police get hold of it.

Take the case of the demobbed Service officer. He is told to retain his equipment until further notice. In course of time, maybe a matter of years, he discovers he still has in his possession a revolver and some rounds of ammunition. What is he to do? The correct procedure is to surrender the arm and ammunition. I am informed that the police do not normally take proceedings against anyone who hands in arms and ammunition, however acquired; but they are legally entitled to prosecute and the decision rests with the Chief Constable. From time to time there have been announcements that no action would be taken against persons who surrendered illicit weapons before a specified date. I suggest it would be advantageous to police and public alike if this announcement were renewed, together with the inducement that in suitable instances arrangements would be made for temporary permits to be issued so that owners could have time to dispose of their arms legally.

If arms or ammunition come into anyone's possession legitimately—*e.g.* having been bequeathed in a will—the correct procedure of the recipient is to apply to the police for Firearms Form 4, through which permission can be obtained for temporary possession long enough for the weapons or ammunition to be disposed of by sale.

While I am generally in favour of the Firearms Acts and quarrel with them only in matters of detail, I cannot say the same of the Prevention of Crime Act, 1919, for it is an ineffective, silly and wholly un-English piece of legislation.

Under this Act, if an old lady carries an umbrella for the purpose of defending herself against a savage dog, she commits a

crime for which she is liable to imprisonment, a fine, or both. And if she is accused of such an offence, she is guilty unless she can prove her innocence! Moreover, a constable can arrest her without warrant on reasonable suspicion that she is carrying the umbrella for the purpose described.

I believe this Act was not aimed at the protection of the public but to satisfy awkward queries on a civil service file. As a protection of the public it is worthless, for a criminal who intends to carry an arm for the purpose of committing a crime will not be deterred by the knowledge of a theoretically additional penalty. He knows that if he is arrested while committing a felony, he will receive an additional penalty for having a firearm in his possession. But he also knows that while, under a further Act, an additional sentence can be given for the mere fact of carrying a weapon of any kind, the chances are that he will not, in fact, have to serve any more time than he would if this Act had never been thought of.

On the other hand, the general public, who at one time were permitted to possess and carry arms for their defence, are now more vulnerable than before, since the violent criminal has the new advantage of knowing that wherever he goes he is unlikely to meet anyone as well armed as himself.

How does this Act affect the sportsman and the target man? A prominent politician is reputed to have said that: "The innocent citizen, including a marksman in his shooting rig, has nothing to fear from the provisions of the Bill." This naïve pronouncement conjures up a queer picture. The marksman does not go about in public in his shooting rig because it would attract too much attention. As Plate II shows, this outfit consists of a wide-brimmed hat, a special shooting jacket plastered with badges, waterproof trousers and green spectacles. On the contrary, he wears his ordinary clothes, except when on the range, and conceals his weapons and equipment as far as practicable. Thus, he is as suspect as anyone else carrying arms. And whereas nine times out of ten you can rely on the commonsense of the policeman or the ordinary citizen, there is that tenth time when the fool makes things difficult. During the war I was arrested no less than five times. In every case I was released immediately my identity was established, but these occurrences were irritating, and serious interruptions in not unimportant

work. Of course, suspicion grows in wartime, but I have had peacetime experiences which strengthen my opinion that the innocent citizen, including the marksman (with or without shooting rig), would be better off if this ill-advised Act had failed to go through Parliament.

Chapter 2

Buying a rifle—English and foreign ·22 rifles—Military rifles—Big game and other sporting rifles—English gunmakers—Buying second-hand

FOR the tyro who wants to learn to shoot, the first rifle purchased should be a proper target rifle, if he is to give himself a reasonable chance of registering decent scores. In this he has the choice of the B.S.A. range of target rifles at moderate prices, and a number of more costly Continental and American models. The B.S.A. "Martini-International" is a very good job that costs a good deal less than its foreign equivalents. At the time of writing it is listed at £30. I believe it is the only target rifle in quantity production designed specifically for both left-handed and right-handed shooters. Particular attention has been given to the trigger pull. The mechanism is on somewhat similar lines to that of a hair trigger; but there is no hair to set, and the trigger weight is adjustable to accord with competition requirements. The manufacturers have tested the trigger let-off by machine and claim that in regular production they can maintain a trigger pull varying by not more than two ounces from shot to shot.

The B.S.A. 12/15 target rifle which, until the introduction of the "Martini-International", was a great favourite of target men is now obsolescent and is to be replaced in 1905 with a new model in the moderate price range.

Foreign models include the Remington 513T at £25: the Remington 37 at £65: the famous Winchester 52 at £67 10*s*.: the Schultz and Larsen Free Rifle at £53 10*s*.: and the "Finnish Lion" at £50. The last two have to be modified slightly to comply with small-bore competition rules.

These rifles, intended for target shooting, can be used for sporting purposes by riflemen who have learnt how to use them, but they are too heavy, particularly those fitted with extra heavy barrels, to be conveniently carried round the field. In any case, the man who wants a ·22 rifle for rabbit potting can choose from a large selection of new and second-hand rifles.

In the manufacture of ·22 rimfire sporting rifles, B.S.A. again have no English competitors. They have available in this class their single-shot, bolt-action "Sportsman" at £6 15*s.*: their bolt-action "Sportsman 5" box-magazine rifle at £8 5*s.*: and their bolt-action "Sportsman 15" tubular-magazine rifle at £9 10*s.* Particularly attractive are the B.S.A. central-fire sporting rifles. The most recent of these is the "Hunter" short-action rifle designed in two styles—Monte Carlo and Continental patterns. It has a modified Mauser-pattern bolt action and a new target-rifle trigger mechanism which, by manipulation of an adjusting screw, has either single- or double-pull. At the time of writing this rifle is available for the ·222 Rem. cartridge, but the ·22 Hornet calibre is expected in the near future.

Among the foreign ·22 sporting rifles are the Zbrojovka Brno* Model 1, ·22 box-magazine rifle at £25 (see Fig. 6): the Walther Model KKJ: the Beretta sliding-bolt action single-shot or automatic rifle at £25: the Lightweight Browning automatic rifle at £15 17*s.* 4*d.*: the Browning pump-action, hammerless repeating rifle at £18 15*s.*: the Winchester Model 74 automatic rifle at £19 6*s.* 8*d.*: and the Zbrojovka Brno ·22 Hornet rifle (for, of course, the Hornet cartridges only) with box magazine and hair trigger at £37 10*s.*

I have not handled all these, and there are some that I have handled but not used, so I cannot give (even if I were willing to do so) any comparative opinion. But I have in my armoury one of each of the two Brno models mentioned above, and I find them exceedingly good for the purposes for which they are intended. I have also seen some very good shooting with a B.S.A. Sportsman which the owner had carefully adjusted and fitted with a telescopic sight, and have heard good reports of the Browning automatic.

To Americans the foregoing would appear a meagre list, for in the States many classes of rifles are made and all types are imported. Also there is a wider range of small game calling for a greater variety of small-bore cartridge. So whereas in England we manufacture and use the short- and long-rifle ·22 rimfire cartridges and but one ·22 central-fire cartridge, the Hornet, the Americans have a vast variety of ·22 "varmint" cartridges;

* Made at the Zbrojovka works at Brno, Czechoslovakia—and often referred to as "Brno" and "Z.B." rifles.

among which the Hornet is one of the least powerful and the ·220 Swift with its muzzle velocity of 4,140 feet per second perhaps the most powerful. Broadly, these high-power ·22 cartridges are of little use in England.

Regardless of calibre, the best value for money on the market are the ·303 service rifles available for sale to the public and recognized for use in "full-bore" competitions. These are the Short-magazine Lee-Enfield, Mark III, officially known as Rifle No. 1: the Pattern '14 Enfield rifle, officially known as Rifle No. 3: and the Rifle No. 4, Mark I, Short-magazine Lee-Enfield.

The last time I saw prices quoted for these rifles they were as follows. Rifle No. 1 as issued, but fitted with a Parker-Hale peep-sight, was listed at £20: fitted with an extra heavy barrel at £22 10*s*. Sometime back, the P'14 rifle was, by a large margin, the least expensive of the three service rifles. But the P'14 is now becoming scarce, and at the time of writing would probably cost in the region of £14. Rifle No. 4, unused, and as issued from government store, is listed at £19: the price quoted for the same rifle, ball-burnished, fitted with aperture sights, and tested, is £26 17*s*. 6*d*.

As soon as one requires anything other than rifles used for target practice and competition, or ·22 rimfire rifles, choice is much wider, for there are calibres suitable for different classes of game or types of country, and prices range from about £12 for converted military rifles to over £500 for a best big-game double. When buying the medium and big-game range, it is as well to go to a gunmaker of high repute, tell him your problem and listen to his advice on what he considers suitable, telling him also what you are prepared to pay. He will advise you on calibre and cartridge for the game you intend to hunt, and will know of any restrictions that may be in operation. For example, in certain British colonies the ·303 is prohibited.

It is always as well to choose a weapon for which ammunition is easily available in this country and abroad, and to avoid completely a calibre for which cartridges are no longer made. It should also be remembered that there are some cartridges which are very similar in description but are not quite the same, nor are they interchangeable. They therefore should not be confused.

English gunmakers differ in the type of business in which they specialize. Some firms make highly expensive "best guns"* and rifles only, and nothing else. Others make best weapons in small quantities, but their main business is in good medium-priced weapons that the greater number of sportsmen can afford to buy. Others have one or two workmen capable of making an occasional best gun but who concentrate on a good international trade in sound but inexpensive arms.

Of those dealing in only the highest quality products, some specialize in rifles, others in guns, and almost all have some speciality for which they are noted. One, for example, may have invented a bullet or cartridge particularly suited for elephant shooting and builds rifles to take it: another may be famed for such refinements as single-trigger mechanisms and detachable locks. Yet another may specialize in shotguns for wildfowling and pigeon shooting—weapons which, being comparatively heavy, are considerably less costly than the lightest of game guns.

The would-be purchaser of a big-game rifle or best gun must study the market for himself. The thing to do is to go round the gunmakers—most of those in London have their headquarters in a small area in the West End—and get their catalogues and some indication of the range of prices. Having done this, have a talk with someone experienced in the buying of sporting guns and rifles. When buying anything expensive it is always worthwhile considering the second-hand market. Many of the more costly weapons have been purchased by wealthy men for use on a single trip and have returned to the market in very good condition. Most of the leading makers have a number of these in stock, either of their own make or manufactured by other first-class firms.

When buying second-hand it is often said that it is safe to rely on the integrity of the gunmaker who would not risk his reputation by selling anything not up to standard. This is probably true of many of the foremost firms who only deal in high quality goods. But it is not a rule that can be accepted without qualification. Since the Second World War, during a period of shortage in small-calibre rifles and pistols, a certain amount of junk found its way on to the racks of gunmakers, and

* "Best gun" is a term used in the trade for the highest quality hand-made shotgun or double-barrelled rifle.

some of it was sold without the examination and testing that a gunmaker who values his reputation should have given.

You often see the term "gunsmith" used where gunmaker is meant. The terms are not synonymous. A gunsmith is a craftsman who works in metal in making and assembling the parts of guns, rifles and pistols. The term "gunmaker" is correctly applied to the firm that takes the customer's order and eventually produces the complete article.

There are very few gunmakers who manufacture under their own roofs everything required in the making of a firearm: and there are some well-known firms who make virtually nothing at all, although they supply guns with their names engraved thereon. Most gunmakers buy partly finished components, which they themselves finish and assemble.

Barrels are made from bars of steel roughly to shape called "blanks". These the gunsmith drills, bores and rifles as necessary, shapes and fits. For incorporation in magazine rifles, complete Mauser and other actions are imported. Roughly shaped blanks of walnut are imported for the making of stocks in the gunmaker's workshop. Some of the work is sent out after the weapon has been partly finished. For example, it is understood that the greater part of the ornamental engraving of London-made guns is done by one firm specializing in that work.

It has been said before, and I say it again, that English firearms of low price are much better than similar-priced goods of foreign manufacture. All are proved, safe and made of excellent materials. The difference between low cost and expensive guns is that the more costly products are made to order and to measure, and involve in their manufacture a great deal of handwork.

Chapter 3

A rural menace—How to avoid accidents—Rules of the range and field—Bursts

THIS man could shoot: of that I had no doubt. He had probably handled a gun since boyhood. But he did not know how to hold a gun safely. He had the fault, for which so many countrymen are notorious, of treating firearms with contempt—a contempt which has been responsible for the majority of gun accidents.

I was walking down a country lane when I came across him. A harvester was making the last few turns of completing a field, and a very small area of corn remained standing. I looked for the man who should be there waiting to shoot the rabbits that would run out as their last area of cover was reduced to nothing. And, sure enough, he appeared behind the harvester. A rabbit broke cover, and the rural sportsman fired a right and left. He went to retrieve his bag. I would have stayed longer, but the gunner, returning to his stance, started swinging his loaded and cocked gun level across the front of his body. When I found myself looking straight into the barrels at a range of less than fifty yards I thought it was time to decamp.

There is no need for firearms accidents. They are practically unknown on rifle ranges, for target riflemen are taught from the first to develop safe habits; and the rules of the N.R.A. and N.S.R.A. are framed to compel safe practices. And what can be done on the range, where thousands of rounds are discharged by all sorts and conditions of men and boys, can be done in the field. In his own interests the shooter should develop the habit of handling his weapon with the utmost regard to his own safety and that of anyone he may be associated with at home, in the field, or on the range.

A gun of any kind should always be treated as if it were loaded, even when it is known to be empty. It should never be pointed at anyone, either by accident or design. When picking up a gun do so in such a manner that it does not point at anyone

(including yourself), and immediately render it harmless by opening the breech. This will soon become a habit if constantly practised.

Farmers and lads of the land are often considered dangerous at a shoot, sometimes with much justification. Nevertheless it was a farmer who taught me to handle a gun safely. He showed me that the gun, on loading, should be closed by lifting the butt, not the barrel: that it should be carried with the muzzle down but not pointing at your neighbour's feet: and if carried on the shoulder, the triggers should be uppermost so that the barrels cannot point at the head of the man walking behind. When we came to a stile he would unload his gun, saying: "Never rely on the safety catch. You might fall, and not every safety catch will stop a gun from being jarred off."

It was later that I learned the rules of organized shoots, which are as much allied to good manners as to the rules of safety. One could go on and on describing the things which should and should not be done, but they all amount to one thing—safety comes first: the shooting of game is a secondary consideration. Whatever you do you must not chance putting a shot in the direction of a fellow sportsman, beater, or anyone else who may be around.

The rules of the target range are similar, but simpler. No weapon is loaded, except when pointing in the direction of the target, after the signal to commence fire has been made. Whenever weapons are brought off the firing point the breeches are opened, and kept open, until the shooter is ready to fire again or puts his gun into its bag to go home.

A shotgun is safer than a rifle for vermin and game shooting, because of its limited range. The pellets seldom travel more than two or three hundred yards, when they fall harmlessly to the ground; and provided the shooter shoots at things that he can see and not into a hedge—where he thinks he sees something —he is not likely to do anyone any harm.

On the other hand, the ·22 rimfire cartridge is dangerous up to three-quarters of a mile and can ricochet from the ground, a stone or a twig—to end up anywhere. For this reason it should not be used in small fields, near hedgerows or in any place where the background does not make an effective bullet-stop.

The ·22 Hornet is safer, for, although it has about five times

the muzzle energy, more than twice the velocity and a longer effective range than the long-rifle cartridge, it has the advantage that the bullet usually breaks up if it hits the ground at a normal shooting distance. Nevertheless even it can ricochet and go whining across the countryside if it touches a twig or anything not sufficiently solid to break it.

I have heard of people shooting clay birds with the ·22 rifle. This must save money on cartridges and call for a high degree of proficiency, but I don't see how it can be done with safety in any part of Great Britain except the most desolate places. A bullet shot into the blue may well find somebody or somebody's live-stock.

Many years ago, long before I became proficient with rifle or pistol, I met in queer circumstances a character who had been round the world and gained varied experience of sporting and military rifles, pistols and guns. He told me many things that he knew, or thought he knew: some undoubtedly sound, some far from it.

One of the things he said I remember well. It was that if anyone were to cut round a paper cartridge so as to nearly, but not quite, sever the portion containing the shot from the remainder, the front end would be blown out of the gun like a solid bullet, with sufficient force to kill almost anything. Well, perhaps it might, but I do not recommend anyone to try it. The danger would lie in the possibility of the front end of the cartridge jamming in the cone of the chamber, thereby causing excessive pressure and a burst, with disastrous results. And even if this didn't happen, the shot would probably blow out of the cartridge, leaving the severed part of the paper in the barrel so that when the next shot was fired it would form an obstruction, causing a ring-bulge or perhaps a burst.

A point for the target man to remember concerns a misfire. If when you pull the trigger there is a click and nothing more, do not immediately flick out the misfired cartridge and go on shooting. Wait for a while to make sure it is not a hang-fire, then bring out the cartridge gently into your hand and examine it to see that it is complete before putting it in a safe place for subsequent disposal. There is always the danger of a cartridge failing to fire, not because the cap composition or priming is missing but because the powder charge has been omitted.

this has happened, the priming explodes and pushes the bullet a few inches down the barrel *without making any audible noise.* And so you can quite easily think that the cartridge has misfired and flick out the empty case, leaving a bullet in the barrel. Then, on firing another cartridge, the second bullet will smack into the rear of the first and cause a bulge in the barrel, with every possibility of ruining its accuracy.

I once saw this happen on the range. A competitor pulled the trigger, heard a click, flicked out the cartridge and put in another, took careful aim and pulled the trigger again. The report did not sound normal, and when he looked through his telescope he found two bullet holes on the target. He did not fire any more shots in that detail, and when he came off the range he inspected his rifle in the clubroom. There was a bulge in the barrel.

At the time I was not certain of the cause of the accident, but I knew that an extra bullet ahead of one in the cartridge, while it could cause excessive pressure in or near the chamber, could not be the cause of a ring-bulge. The bullets of ·22 rimfire cartridges are fixed in too firmly to come out like that and remain in the chamber. Furthermore, were a bullet to remain in the chamber it would not be possible to insert another cartridge except by using considerable force. So later on I tried the experiment of breaking a bullet out of a cartridge, emptying out the powder charge, putting back the bullet and firing it at a target. The hammer clicked and there was no suggestion of an explosion; but when I took out the fired case I found the bullet had gone. By probing with a cleaning rod I ascertained that it had moved seven inches up the barrel before coming to rest.

Chapter 4

Momentum and energy—Types of bullets—Gunpowders—Interior ballistics

THE study of bullet and cartridge design is exceedingly complex: it is partly mathematical, but more largely empirical.

A bullet from a hunter's rifle can be instantaneously fatal to an animal, can cause slow death or a mere temporary inconvenience, according to the part of the animal it hits and the state of health or excitement of the animal at the time. To make certain of bringing down any particular animal the bullet designer aims at producing a wound which is large enough to be effective but not so large as to destroy too much meat: and deep enough to reach a vital part but not so deep as to cause the bullet to go right through and waste its energy. He can achieve these ends in two ways: he can have a large bullet travelling at a comparatively slow velocity, or a smaller bullet having a higher velocity, which carries as much or more energy. The smaller bullet is often designed to expand in order to make a larger wound.

But wounding effect is not the only consideration, as high velocity is necessary to give a flat trajectory, reducing error of aim at long range. A long bullet travelling nose first, provided it has sufficient spin to keep it pointing the way it is going, has longer range and more sustained velocity than a round bullet.

Early bullet designers were much concerned with the determination of the right bullet weight and length, and correct charge to secure accurate flight. And, according to records, they encountered many difficulties and explored some blind alleys. But that aspect of bullet design is now fairly well understood. The problem that has more recently been a matter of controversy with both ballisticians and sportsmen is whether or not a light high-velocity bullet can, in fact, do the work of one that is heavier but not moving so fast.

Ballisticians, being physicists, state that as energy is the power to do work, it is the true measure of wounding power: and,

because the energy of the bullet varies directly as its weight and as the square of its velocity, the same result can be obtained by slightly increasing the velocity and more greatly reducing the weight. And, as increase of velocity has the added advantage of improving trajectory, the small high-velocity bullet has considerable theoretical appeal.

However, some big-game hunters of wide experience contend that pure theory does not conform to practice. They have found that a heavy bullet is more effective in instantly bringing down big game than a lighter bullet of equal or sometimes greater energy of impact. And so recent developments in cartridges and bullets have been based on a combination of the experience of sportsmen and the theory of the ballistician.

The energy imparted to the bullet by the powder gases is in direct proportion to the product of the distance that the bullet travels through the barrel and the average force exerted by the gases on the base of the bullet over that distance. An increase in the pressure or the distance over which it is applied obviously means a proportional increase in bullet energy. Thus, if twice the force were applied by the gases, a bullet of twice the weight could be impelled at the same velocity.

On the other hand, an increase of explosion energy does not increase the velocity proportionately, as the velocity goes up only as the square root of the energy applied. Therefore the energy of the bullet can be measured in terms of the product of the mass and the square of the velocity, according to the formula:

$$\text{energy in foot-poundals} = \frac{mv^2}{2}$$

or

$$\text{energy in foot pounds} = \frac{mv^2}{2g}$$

where

m = weight of bullet in pounds
v = velocity in feet per second
g = pull of gravity (approximately 32·2)

A bullet which is brought to rest by impact with a solid body exerts a pressure, and—making due allowance for energy lost between leaving the gun and arrival at the target—the energy dissipated by impact is equal to the energy exerted by the powder gases. If the object struck is hard and resistant, the bullet will be brought to rest after penetrating only a very short

Plate IV. B.S.A. "Hunter" Short Action Rifle.

Plate V B.S.A. "Martini-International" Target Rifle.

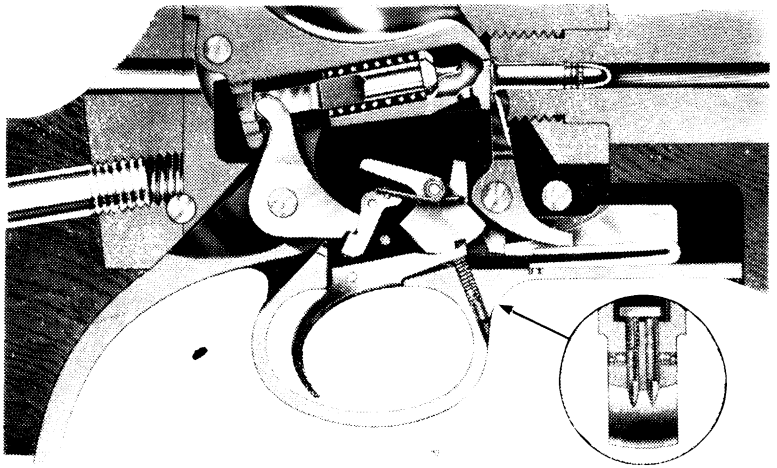


Plate VI. Action of B.S.A. "Martini International".

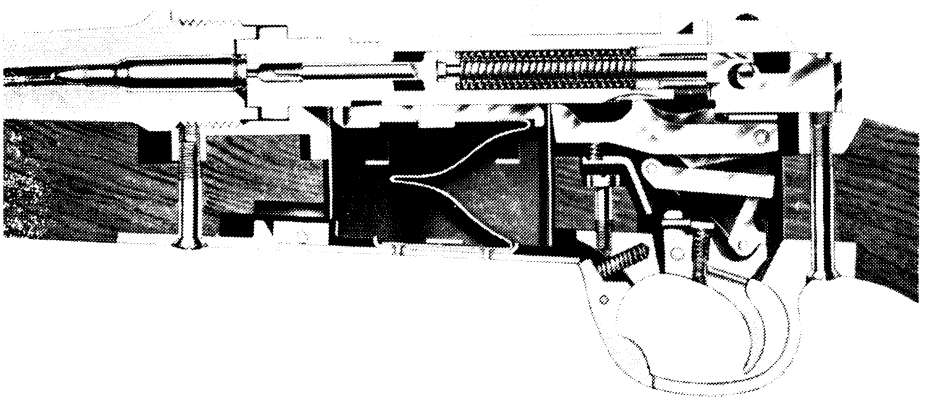


Plate VII. Action of B.S.A. "Hunter".

distance while exerting great force; if soft, it will travel a long way before coming to a stop, because the force of impact is less. The product of the distance penetrated and the force exerted is the same in each case. To penetrate a resistant material the bullet must exert sufficient pressure to cause rupture, and its ability to do this will depend on its energy.

The *momentum* of a bullet is its mass multiplied by its velocity. It is not in direct proportion to the energy of the explosion for, given the same explosive power, the momentum of a heavy bullet is greater than that of a light one. Momentum is necessary for penetration because, on impact, the bullet's momentum is taken up progressively by the material struck. Even after the bullet is finally brought to rest, the target or parts of it carry on the motion.

Place two pennies on the top of a polished table and lightly push one towards the other; both are quite easily moved. Now place one on the table and slide the other gently towards it. If it hits it squarely, the moving penny stops dead, while the stationary penny takes up the movement and goes on. Now impel it against the other somewhat harder. Again, the moving penny is stopped dead. Now, using all the force you can, try to drive one penny so hard into the other that both go on together. You can't do it; each time the moving penny is stopped dead, though the other flies off the table.

This illustration shows that a projectile can be stopped absolutely by square impact with a mass of material equal to (or greater than) it in weight. But this is true only if the impact *is* square. If one penny hits the other at an angle, the first is deflected from its course but continues on in a new direction at a reduced velocity, part only of the energy being taken up by the penny that was hit.

Prior to the Second World War, experiments were carried out to determine the penetration of bomb splinters into different materials. After the tests on penetration of wood (a compressible substance having structural strength) it was concluded that:

> "The penetration is a function of the momentum possessed by the fragment and also of the area presented to the target. Thus a long fragment will achieve greater penetration if it strikes the target end-on than broadside on."

The penetration of wood should be somewhat similar to the penetration of bone: but not to flesh, which is soft but, being saturated with liquid, incompressible. In connection with soft substances the findings were summarized as follows:

"Within limits the penetration into a very soft substance, such as plasticine, is independent of velocity. In other words, total penetration is not greatly increased by a large increase in velocity. The volume of material displaced, however, appears to be proportional to the striking energy, that is to the square of the velocity, while the rate of destruction of energy near the surface of impact appears to be proportional to the cube of the striking velocity. . . ."

"The greatest damage occurs near the point of entry, the disturbance of material decreasing as the fragment penetrates more deeply. This is contrary to the effect produced by a bullet, which makes a small hole at, and after, entry until it deviates from its path and breaks up, when a large cavity is produced."*

The interpretation of the foregoing is that a bullet to do damage must have energy; to penetrate it must have momentum. A bullet can be given increased energy by simply boosting up the velocity; but for this energy to be usefully employed the penetration must be such that the bullet goes deep, and for this weight is required.

It follows that if a blunt-nosed bullet is to penetrate for any distance through the flesh of a large animal, it must be sufficiently heavy to be not less in weight than the flesh displaced. If the bullet is to be used for a brain shot against an elephant and has to pass through a considerable thickness of bone, it must be long in the direction in which it is travelling and must not flatten out; for if it did, it would make a bigger hole and be resisted by a greater weight of flesh and bone. Accordingly bullets for elephant hunting are large and heavy and comparatively long. They are not too pointed, but rounded at the front, for points can turn over causing a bullet to turn sideways. And they are cased in steel (under the outer covering of gilding metal) so that the lead will not flatten out.

* Reproduced from A.R.P. Handbook No. 5 Structural Defence, by sanction of the Home Office and H.M. Stationery Office.

There is, however, nothing to be gained by designing a bullet purely to penetrate, for if it penetrates entirely, comes out the other side of the animal and continues at high velocity across the countryside, the greater part of its energy is wasted on whatever finally brings it to rest: a much weaker cartridge might have been used, with equal effect.

A powerful cartridge is necessary to bring down a big but easily penetrated soft-skinned animal, *e.g.* a lion, and it must be one which will expand to spread its effect and dissipate its entire energy by the time it reaches the skin on the other side. Consequently, for soft-skinned animals expanding bullets are used with soft noses that "mushroom" on impact. These are effective on lions and tigers; but merely spatter out, making nasty, but not fatal, surface wounds if used on thick-skinned animals like the rhinoceros, and have no effect at all on the horns protecting the forehead of the buffalo.

Thus, to secure the optimum condition, each type of bullet is designed for its own specific purpose. If it is intended, as is the military bullet, to penetrate without expansion, it has a metal jacket that covers it from the nose to the base, being open at the base only. If it is intended to expand a little, the gilding metal exposes a little lead at the nose but encases the base. If more expansion is required, more of the nose is exposed. (Bullet jackets are never made open at both ends; for if they were, the lead would be blown out of them, leaving the jacket behind.) There are many other special designs of bullets, such as hollow-point bullets which expand very easily, and bullets which are so made that the nose expands but the base is kept from expanding.

Another phenomenon of bullet effect is hydraulic shock. A bullet travelling at a low velocity can leave behind it a hole which is little larger than its own diameter. At a higher velocity the bullet mushrooms, or breaks up, causing more damage and, if it strikes a bone, particles of bone may fly in all directions, themselves causing damage over a still wider area. But when bullets with high muzzle velocities of 2,250 or more feet per second strike before they have lost much velocity they produce the effect known as "hydraulic shock"—a phenomenon which occurs only in tissues saturated with water, or vessels containing water or other incompressible fluid. What happens is that the bullet hits the liquid-saturated tissue with such force that the fluid is

driven away in all directions, tearing apart the tissues containing it.

The wound resulting from hydraulic shock is easily distinguished. On the side of the animal where the bullet enters is a small hole, but inside there is a large cavity, and if the bullet goes right through it leaves a great hole on the outgoing side.

The term "gunpowder" is used not only for old-fashioned black powder consisting of charcoal, potassium nitrate and sulphur but also for any propellant used in guns. Black powder was, and still is, a useful explosive and effective as a propellant.

Propellant powders are classed as black powders, nitrocellulose or single-base powders, and nitroglycerine or double-base powders (containing both nitrocellulose and nitroglycerine). The last two types are known as "smokeless powders". All the powders other than black powders contain additional substances that serve as stabilizing agents to make the powders keep, or deterrents to prevent too-rapid burning.

Black powder is of ancient origin and may have been known as early as A.D. 600. But many authorities consider that the discovery of gunpowder was made in the year 1313 by a German Franciscan monk, Berchtold Schwarz. In early days it had the same ingredients as present-day black powder, but not in the same proportions. Also the early powders contained many impurities which reduced their efficiency. Modern black powder consists of 75 per cent. saltpetre, 15 per cent. charcoal and 10 per cent. sulphur.

Smokeless powders originated as a result of the discovery of gun-cotton by Schoenbein in 1845 and nitroglycerine by Sobrero in 1846; and their development owed much to the work of Alfred Nobel, who among other things discovered that nitrocellulose and nitroglycerine and other materials could be incorporated to form a propellant powder.

The choice of powder in accordance with load is a matter of burning speed. A quick-burning powder is used for a light load to make up for lack of resistance offered by the load; a slow-burning powder is used for heavy loads with which quick-burning powders would develop excessive pressures unless used in such small quantities as to be ineffective.

The following are the comparative qualities of the various classes of powder. Black powder ignites readily, burns quickly and keeps well in storage. On the other hand it produces clouds of smoke, causes a heavier recoil than other powders and heavily fouls the barrel of the gun. Its speed of burning is controllable to a moderate degree by choice of size of grain.

Single-base powders burn at low temperatures and therefore produce comparatively little erosion. They are not much affected in performance by temperature, and rate of burning can be controlled in several ways. Their disadvantages are: they are not easily ignited with weak cap compositions; they are comparatively weak in proportion to weight of charge; and to some extent they tend to take up moisture from the atmosphere.

Double-base powders are easily ignited, powerful in proportion to weight of charge and not liable to absorb moisture. They have, however, the disadvantage of causing more erosion of the barrel than other powders, owing to high-temperature burning. In hot climates they are liable to exude nitroglycerine during storage.

Before the war, I.C.I. advertised the familiar shotgun powders, Smokeless Diamond, E.C. No. 3, and Empire, which were 33-grain bulk powders; Modified Smokeless Diamond, a 36-grain powder; Schultze and Amberite, 42-grain powders; and Sporting Ballistite, a dense powder. Since the war, I.C.I. have been loading cartridges with a new powder known as Nobel Powder No. 52, which was tested and pronounced satisfactory in 1949. This powder was introduced to reduce the cost of production.

The American Du Pont powders include Du Pont Smokeless, or Du Pont Bulk as it is sometimes called, which is recommended for medium and light loads; Du Pont MX Smokeless, a multi-base powder for medium and light loads; and Du Pont Oval, a multi-base powder for heavy loads.

In the summer of 1954 I wrote to I.C.I. to enquire the position as to the availability of shotgun powders, and was informed that:

". . . the smokeless powders presently available are described as 'Smokeless Shotgun Nobel Powder'—No. 60 for normal game-load cartridges, and No. 62 for medium to heavy-load cartridges.

"Smokeless powders are available only in bulk packing for gunmakers who undertake their own loading, and are not supplied in small canisters."

It is, of course, possible for shooters who want to reload their own cartridges to obtain small supplies by applying to some obliging gunmaker who does his own loading: but in such circumstances the advice of the gunmaker should be obtained as to the amount of powder to be used.

In America, where canisters for amateur use are made on a large scale, the powders of each batch are carefully tested and leaflets are prepared recommending the charges for all loads in which the particular powders may be used. In Great Britain, however, where there are no canister powders available other than the diminishing remainders of old stocks, there is no trade literature to which the amateur reloader may refer. I should mention that at the time of writing there are no American canister powders available in Britain, and, I am informed, not likely to be for many years.

The shooter who wishes to economize may, however, fall back on black powder which, for all its dirtiness and smokiness, is a good reliable propellant. It is available in canisters, but a police permit is required. Suitable loads are given in Table 4.

Once many people loaded their own shotgun cartridges, buying the primed cases, putting in powder, wads and shot, and recrimping; or reloaded old cases, fitting new caps before inserting the charge. Local dealers filled cartridges to customers' requirements, and these "tailor-made" products, though generally inferior to factory-filled cartridges, were often much preferred by sportsmen who had not the means or the ability to make comparative scientific tests.

At the present time there is much more reason for the reloading of old cartridges than formerly, for cartridges are expensive and money is scarce. Nevertheless, home loading and reloading have become much less common than formerly. This may be due to a change in the attitude of people generally to evening occupations, but it has been suggested that the difficulty of obtaining suitable powders is more to blame, for the machinery can be obtained and doesn't cost too much.

The reloading of central-fire metallic ammunition is practically unknown in this country. This again is probably largely due to

lack of interest, but it is said that the ammunition manufacturers will not supply either the percussion caps or the special powders, except to a very small number of recognized expert experimenters.

The position is quite different in America. There the manufacturers, who at one time opposed hand-loading, discovered that this was an error in policy. The effect of the growing popularity of hand-loading was not a reduction in the sale of ammunition, but a vast increase in popular interest in the technical side of shooting and in the sale of hand-loading equipment, cartridge cases, primers, powders and bullets. Now, hand-loading in America is thoroughly established: several textbooks have been written on the subject—large weighty volumes—and firms such as the Lyman Gun Sight Corporation make the necessary tools.

The result of this had been not merely to create an interesting hobby and a source of commercial profit, but genuine discoveries have been made in the course of the design of "wildcat" cartridges and other experiments with loads.

At the time of writing, the dollar restrictions are the chief impediment to the reloading of metallic ammunition in England. As the machinery and materials are not obtainable in this country they have to be obtained on import licence from the United States, and there might be some trouble in persuading the Board of Trade that the import of these goods is absolutely necessary. It appears that the trade can do nothing: I do not know what the reaction of the Board of Trade would be to individual persons, for as yet I have not attempted to import the necessary materials.

The propellants used in guns are "low explosives" which burn at a very low speed compared with high explosives such as T.N.T. This slow burning is a necessary property, for even a very small quantity of high explosive would split the barrel of a gun, because the rate of expansion would be too rapid for the pressure to be relieved by the movement of the bullet down the barrel. There is a right speed of burning for every purpose. A pistol with its short barrel can use a faster burning powder than a rifle; while a rifle benefits from the prolonged production of combustion gases during the time the bullet moves down the barrel.

An explosive can be caused to burn only by being raised to the temperature at which combustion starts. In a firearm, the charge is ignited by the blow of the striker; but it is the heat

produced by this blow that causes the cap composition or primer to explode. (Some primers contain powdered glass to increase the friction caused by the impact.)

That heat, not mere shock, is necessary to ignite explosive has been demonstrated by a simple experiment. A little nitroglycerine was poured on to a smooth anvil and then struck with a smooth hammer. Nothing happened. Then it was struck with a hammer which had a tiny indentation in its surface, whereupon the nitroglycerine exploded. The reason was that the air trapped in the hole was compressed by the hammer blow and, as always happens when gas is compressed, became hot. Its heat ignited the explosive.

When a propellant burns it produces heat, but not necessarily enough to cause an explosion. If you break open a cartridge, pour out the nitro-powder and ignite it with a match, it burns readily but does not explode. But when a propellant is ignited in the chamber of a gun, not only is heat produced by the burning but the rapidly evolved gases produce pressure which in its turn produces more heat and consequently still more rapid burning. For this reason the amount of space in which the explosion takes place is of great importance: if it is too large, it will cause a weak explosion; if too small, it may result in excessive pressure.

Thus it will be seen that a number of factors have to be considered in the design of a cartridge. First, there is the powder, its quantity, type and rate of burning; second, the space in which the powder initially starts to burn; and third, the weight of bullet or charge of shot. The last is of no small importance, for a light bullet or charge of shot is driven away before the explosion has developed its full pressure. A heavy bullet or charge of shot resists the explosion and causes the pressure to build up. There is, of course, an optimum relation of bullet weight to powder charge.

The cap composition or primer that ignites the powder charge also has to be matched with the powder. If the explosion of the primer is feeble, it may fail to light the powder sufficiently rapidly and cause a weak or inconsistent explosion. If it is too violent, it may cause excessive pressure. In ideal circumstances it should explode so as to produce sufficient heat to start the powder burning at the rate desired: and all primers in the same

type of cartridge should be alike in effect, not patchy or irregular in performance.

I have already mentioned that the energy of a bullet depends on the distance travelled through the barrel and the *average* force exerted by the powder gases over that distance. If a constant pressure was exerted by the gases for as long as the bullet remained in the barrel, the bullet would gain kinetic energy in direct proportion as the distance that it travelled down the barrel, and velocity according to the square root of that distance. But this does not happen, because the pressure of the gases does not remain constant. At the moment of ignition the pressure builds up rapidly as the powder burns. But there is a progressive decrease of pressure when the bullet moves, because there is more space in which the gas can expand. With the consumption of the powder and the reduction of the surface area of the individual grains as they get smaller, the rate of gas production becomes less.

The overall result of these facts is that whereas considerable velocity and energy are gained by the bullet during the first few inches of its journey down the barrel, much less advantage is gained by its further travel. Accordingly there is very little difference indeed between the performance of a rifle or gun that has a barrel-length of thirty inches and one of a barrel-length of twenty-four inches. Similarly, although a target pistol may have a barrel six or nine inches long, pistols for practical use have four-inch or two-inch barrels and are still effective.

If the barrel is very long and the powder charge small, there may even be a disadvantage in barrel-length. For example, the maximum velocity of the bullet of the ·22 long-rifle cartridge occurs when the bullet has travelled eighteen or twenty inches down the barrel; after that, velocity falls off because the friction between the bullet and the barrel produces a retarding effect greater than the acceleration produced by the residual pressure of the gases.

It is because of the quick fall-off of pressure that barrel-bursts due to excess of pressure never occur other than close to the breech. Such bursts are usually due to excessive pressure such as may be caused by an overload of powder or shot, or some stoppage just ahead of the cartridge. If a burst occurs other than near the breech it is due either to a flaw or other weakness

in the metal, or to some obstruction against which the bullet or charge of shot and the powder gases impinge. If it is due to weakness, the barrel cracks or opens up; but if the burst is due to a stoppage, one or more ring-bulges are formed, and these will be present whether or not the stoppage was sufficient actually to burst the barrel open.

It will be seen that very high velocities could be produced without the development of momentary excessive pressures if gunpowders could be so made as to produce constant pressure throughout the period that the bullet travels down the barrel. So far this has not been achieved. "Progressive powders"—*i.e.* powders that burn fairly steadily—are made. But even the best of them develop high pressures which fall off rapidly.

The disadvantage of momentary high pressures is not so much danger of bursting the gun—that can be overcome in design—but excessive wear of the bore. This is noticeable particularly in the immediate vicinity of the lead, and, of course, wear reduces the life of the barrel. It is mainly due to the scouring effect of the hot gases as they escape past the bullet before it has expanded sufficiently to fill the rifle. It is one reason for not selecting a cartridge which produces too high a pressure. The ·22 rimfire rifle can be said never to wear out with use, but only by either excessive cleaning or neglect. On the other hand, a fairly high velocity sporting or military rifle has a barrel life of a mere two or three thousand rounds.

Chapter 5

Cartridges—Rifling—Accuracy

In the days of muzzle-loading, the charge of powder was ignited by the flint or by the percussion cap, and, when it exploded, some of the gas escaped through the hole near the breech. This did not matter, for the quantity of gas lost was small, and the flame was deflected away from the shooter's face. In the early days of breech-loading an attempt was made to seal the breech of the rifle by very precise workmanship in the breech-block, but it was not an unqualified success. Eventually it was found that the expansion of a cartridge-case under the initial pressure of the explosion could be sufficient to seal the breech and prevent any appreciable gas leakage, provided the cartridge was properly proportioned and of wall thickness suitable to the gas pressure developed.

Old-time muzzle-loading cartridges were paper packets in which were assembled the charges of powder and shot. The shooter bit off the end to expose the powder and rammed the rest of the cartridge down the barrel. Modern cartridges are either metallic—*i.e.* made entirely of brass or other metal—or shotgun cartridges made partly of paper and partly of brass. Metallic cartridges are divided into two main classes: rimfire and central-fire; shotgun cartridges are central-fire.

The case of the rimfire cartridge is pressed out of sheet copper, brass or (rarely) cupro-nickel and is in one piece. The cap composition is deposited by machine inside the hollow rim at the head, after which the case receives its charge of powder, the bullet is inserted and crimped in position.

When placed in a rifle the rim of the cartridge prevents the cartridge from going in too far, although when the rim is resting in its annular recess the ogive of the bullet is usually close to, or pressing into, the rifling of the barrel. The cartridge is fired by being struck on the head by the firing-pin or striker close to the rim so as to crush the cap composition that is inside the rim, and by the heat of the impact cause it to ignite. In order that the

blow of the striker shall be effective the rim of the cartridge must be firmly supported against the face of the breech: in other words, head space must not be excessive.

Rimfire cartridges are much easier to manufacture and, therefore, much cheaper than central-fire cartridges, but are limited to cartridges of small diameter and moderate pressure. Within its limitations the cartridge is very useful, in particular for target shooting, for good batches of the ·22 long-rifle, rimfire cartridges are sufficiently accurate to satisfy expert target riflemen, and the general run of ·22 ammunition is plenty accurate enough for the requirements of the average sportsman.

The ·22 rimfire ammunition is manufactured in three lengths: "short", "long" and "long rifle". The "short" is much favoured for sporting purposes because of its low cost; the "long" is tending towards obsolescence. The "long rifle" is invariably used by the small-bore target man, and is the best of the three types for sport, having the most power. Both "short" and "long" are made in two types: standard and high velocity; and "long rifle" in three types: standard, rifle club or all range, and high velocity.

Bullets are solid lead in all types, with the alternative of hollow point in the high-velocity types.

There is also a pistol grade of "long-rifle" cartridge. This has an extra weak powder charge to minimize recoil and improve target accuracy. Special target grades are also available from time to time. The ballistics of the ·22 rifle cartridges, apart from the pistol cartridge, are given in Table 1.

The ·22 rifle is said to be temperamental and very fussy about the ammunition that is pushed into its breech. This is probably because tolerances are of greater importance than in a larger calibre. Expert riflemen who seldom drop a point on the small-bore range can detect differences in the mechanical accuracy of their rifles and in different makes and even batches of ammunition. So, as soon as they find a batch that gives the best results, they buy up as much as they can. This is one of the reasons why anyone taking up target shooting seriously should insist that his certificate covers a goodly stock of ammunition.

For sport such refinements do not matter, and if you use the ·22 "long rifle" in the field, ordinary English high velocity is quite accurate enough and much cheaper than some of the fancy American rounds.

TABLE I. BALLISTICS OF I.C.I. ·22 RIMFIRE AMMUNITION

	Bullet weight (grains)	Muzzle			25 yds.			50 yds.			75 yds.			100 yds.		
		Velocity f./s.	Energy ft.-lb.	Drop in.	Velocity f./s.	Energy ft.-lb.	Drop in.	Velocity f./s.	Energy ft.-lb.	Drop in.	Velocity f./s.	Energy ft.-lb.	Drop in.	Velocity f./s.	Energy ft.-lb.	Drop in.
22 L.R. High Vel.	40	1,400	174	—	1,272	144	0·6	1,169	121	2·5	1,090	103	6·1	1,036	95	11·4
·22 L.R. Rifle Club	40	1,200	128	—	1,114	110	0·8	1,053	98	3·3	1,005	90	7·8	962	82	14·5
·22 L.R. Standard	40	1,025	93	—	980	85	1·1	938	78	4·4	900	72	10·2	865	67	18·7
·22 Long High Vel.	30	1,375	126	—	1,215	98	0·6	1,102	81	2·7	1,028	70	6·6	968	62	12·5
·22 Long Standard	30	1,025	70	—	966	62	1·1	913	55	4·5	865	50	10·5	822	45	19·5
·22 Short High Vel.	30	1,150	88	—	1,060	75	0·9	996	66	3·7	940	59	8·7	890	53	16·1
·22 Short Standard	30	925	57	—	876	51	1·3	833	46	5·5	791	42	12·7	751	38	23·5

The serious competitor has always to watch the occasional faulty round, even when he has a stock of "vintage" ammunition. Duds are admittedly rare, but if there is one in a batch there may be more owing to the repetition of the same error during manufacture.

The loss of a point or two by the firing of one bad round may ruin one's chances in a competition, and for this reason the serious competitor should first inspect and then weigh each round on a delicate balance and discard all cartridges which are under- or overweight. For a cartridge to be below the average weight usually means that the powder charge is below standard or absent. Before a rapid-fire competition, particularly if the rifle is a Martini with a short chamber, all rounds intended for use should be put through the chamber and any that give trouble discarded. Walter Winans, the famous pistol-shot, always did this.

Central-fire cartridges are made in a large number of operations from sheet brass, which is alternately pressed and annealed until the case has received its final shape and requisite degree of hardness. The percussion cap is a separate cup of copper or brass containing the cap composition. This is pressed into a chamber in the base of the cartridge, from which one or more holes discharge to the inside of the cartridge and which contains a projection known as the "anvil". When a central-fire cartridge is fired the striker crushes the base of the percussion cap against the anvil, crushing and firing the cap composition. The gases from the explosion escape through the hole or holes into the body of the cartridge, igniting the powder. The bullet is held in the neck of the cartridge by a crimp or indentions.

Central-fire cartridges are described as "flanged", "rimless", "semi-rimless", or "belted", according to the arrangement for preventing the cartridge from going too far into the chamber. If the cartridge enters too far, even by a matter of some thousandths of an inch, the head space—*i.e.* the amount of freedom of backward and forward motion of the cartridge case when the breech is closed—becomes excessive. This can be dangerous, causing the cartridge to tear in half; it can cause misfires; it is always liable to result in inaccuracy.

Flanged cartridges are best for all single-shot rifles because they are most easily made to the degree of accuracy necessary for

satisfactory head space. There is seldom justification for the single-shot rifle being made to take any other type, unless the owner is also the owner of a magazine rifle requiring a rimless or belted cartridge. He may then find it advantageous for his single-shot rifle to take the same type of cartridge to avoid having to keep two kinds of cartridge of the same calibre.

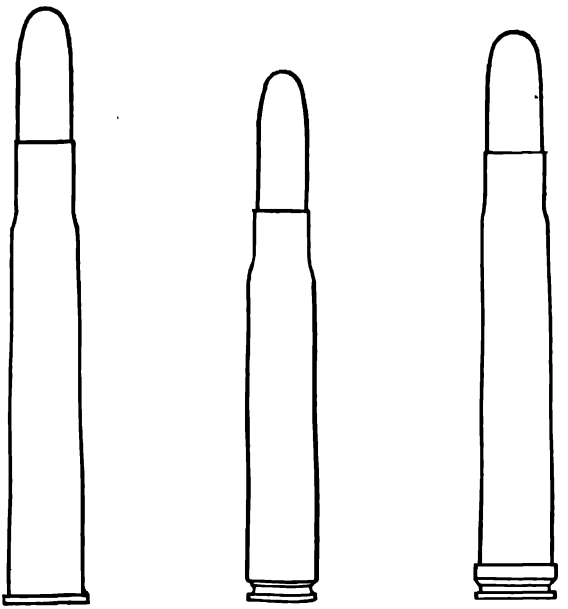


FIG. 1. Central-fire Cartridges: Flanged, Rimless and Belted Rimless.

Flanged cartridges sometimes cause mal-functioning with repeating and semi-automatic mechanisms because the flange of one cartridge catches on the flange of the next in the magazine. This was not a serious trouble with some types of rifle, but it created sufficient difficulty with others to bring about the design of cartridges that had no projecting flanges or rims at the head.

The rimless cartridge has, in place of a rim, an annular groove into which the hook of the extractor of a bolt action or semi-automatic weapon drops. As there is no rim to limit head space, the bottle-shaped cartridge is prevented from going too far into the chamber by the shoulders near the neck resting against the inside of the chamber. Or, if the cartridge has no shoulders, the

edge of the neck resting against an edge in the chamber. This design necessitates that the two faces fixing the position of the cartridge in the chamber—the base of the cartridge and shoulders or foremost edge—must be made an exact distance apart to a high degree of accuracy. And as this distance is not small it is difficult to maintain the accuracy when manufacturing large quantities of ammunition.

Semi-rimless cartridges are like rimless except that the part of the head that lies behind the extractor-groove is very slightly larger in diameter than the rest of the case. Thus when the cartridge is in the chamber the edge of this rests against the breech-face. In other words, the semi-rimless cartridge has a rim but its projection is almost microscopic.

The belted cartridge has a belt of slight projection forward of the extractor rim which prevents the cartridge from going too far into the chamber. Like the rim of the semi-rimless, the belt projects only very slightly and does not interfere with repeating mechanisms. This design is favoured for magnum repeating rifles.

When a cartridge is fired the pressure builds up rapidly, expanding the walls of the case until they press tightly against the sides of the chamber, preventing any leakage of gas to the rear. As the case expands, the bullet is released and begins to move forward through the lead into the rifled barrel. But the inertia of the bullet prevents it from starting to move as rapidly as the powder gases, which impinge on the base of the bullet with so great a force that it is expanded to fill the rifling. The bullet then proceeds down the barrel at increasing speed and increasing rate of rotation until it leaves the muzzle.

The purpose of the spin of the bullet from a rifled firearm is twofold: it ensures straight and accurate flight, and makes possible increased range and harder hitting power.

If pressure is low, it can fail to expand the case in time to prevent leakage of gas to the rear. This is one reason for occasional blowback with brass-cased ·22 rimfire ammunition.

A bullet from a firearm that is not rifled takes a curved or irregular course in the air, dependent on any imperfection of its shape and any spin that it may have picked up during its course down the barrel. But if the barrel is rifled so that the bullet is made to spin about an axis in the direction of its flight, the

tendency to curve aside from its course is balanced out: instead of sweeping off in inconstant direction it follows a spiral course, the central axis of the spiral being towards the mark.

Increased range and hitting power are achieved because the gyroscopic effect of its spinning is to keep the nose pointing in the direction in which it started, and the slip-stream converts this to pointing in the direction in which the bullet is travelling. This makes possible the use of long, narrow bullets which in their journey from the muzzle to the target have to push aside less air than they would if they were, for example, spherical. And so, meeting with less resistance, they retain their velocity longer and have more kinetic energy left when they hit the mark. This, in addition to improving killing effect, gives a lower trajectory, lengthening the point-blank range of the rifle and reducing the amount of allowance to be made for distance in sighting.

The longer the bullet, the greater the speed of rotation necessary to keep it pointing in the direction in which it is to go, and therefore the sharper the pitch of the rifling. There is, however, a limitation on pitch. If the rifling twists too sharply, the bullet instead of acquiring spin will merely drive through the rifling, leaving behind shavings off its sides. To overcome this, bullets other than low velocity need to have jackets of metal harder than lead to grip the rifling. The jackets also prevent melting of the lead, which can occur at high pressures.

For low velocities, lead or lead-alloy bullets can be used. Lead-alloy is satisfactory, for example, for ·22 rifles giving muzzle velocities of 925 to 1,400 feet per second. These ·22 rifles usually have a twist of one turn in sixteen inches. At the lower velocities the bullets must be short—as in the ·22 short cartridge—but may be longer when the velocities are higher—as in the case of ·22 long-rifle cartridges. Where pitch of rifling is constant, velocity of spin increases directly as muzzle velocity. When the velocity is increased to 2,500 feet per second, as in the ·22 Hornet cartridge, the same pitch of rifling is satisfactory, but it is necessary for the bullet to be jacketed with gilding metal in order that it will not sheer its way through the grooves without acquiring spin.

For a rifle to be accurate the chamber must be perfect so that the bullet does not become distorted when its base is expanded by the explosion; the bore must be even in diameter throughout

its length, straight and free from pitting or other imperfections; the muzzle should not be bell-mouthed (the necessity for this is controversial); the barrel should be heavy and properly bedded to the stock; the breech mechanism should be such that the deflection of its parts under the pressure of the explosion is as slight as practicable; the head space should be small.

Chapter 6

Exterior ballistics—Ballistic tables—Elevation for target rifles—Sighting of sporting rifles

A PROJECTILE after leaving a gun travels with decreasing velocity because of the resistance of the air. At the same time it accelerates towards the earth under the influence of gravity. Theoretically a projectile starting at an angle upwards follows a parabolic trajectory, but this knowledge is of little practical value, for the curve which a bullet takes through the air is influenced by the density of the air which, in turn, is influenced by barometric pressure, temperature and humidity.

The foundation of our knowledge of air resistance was a series of experiments made by the Rev. F. Bashforth, B.D., between 1867 and 1879. In the course of his research Bashforth decided that air resistance could not be represented by a simple mathematical law over a wide range of velocity. Accordingly he measured velocity experimentally and, by means of complex calculations, prepared ballistic tables.

This original work related to projectiles fired from cannon. But early in the 1918's F. W. Jones carried out experiments at Hodsock on which were based the Hodsock Tables; these were completed in 1919 by O. Western and are published in Major Sir Gerald Burrard's *Notes on Sporting Rifles*. I am given to understand that ammunition manufacturers in Britain use the ballistic tables that were published by the War Office in *The Textbook of Small Arms*, 1920.

For a bullet to have a flat trajectory it must have a high velocity. For it to travel a long way it must start at a high velocity and maintain reasonably high velocity during the whole of its flight. The ability to retain velocity is expressed in the "ballistic coefficient" of the bullet, a figure which depends on both the sectional density and the coefficient of form. The sectional density is given by the formula: W/D^2; W being the bullet weight in pounds and D the diameter in inches. The coefficient of form depends on the shape of the nose of the bullet

—the "ogive" as it is called. The ballistic coefficient is the sectional density divided by the coefficient of form. A bullet with a high ballistic coefficient retains its velocity better than one with a coefficient of low value.

Given the muzzle velocity and ballistic coefficient of the bullet and provided with a set of ballistic tables (or of diagrams such as some Americans prefer to use), the rifleman can make, somewhat laboriously, any calculations he wishes. He can plot on graph paper the trajectory of the bullet of any cartridge and decide theoretically just how to set the sights of his rifle for any particular purpose. What is more to the point, he can assess the values of cartridges for use against different classes of game.

But even with the aid of tables and diagrams these calculations are laborious. They have to be made in stages; and to work out the trajectory of one cartridge can take an hour or so. Therefore it is a blessing that Imperial Chemical Industries give enough information for practical purposes in their Table of Standard Ballistics. (See Table 2.)

The rifleman is essentially a practical man, more concerned with the results of experience than theory, but some knowledge of ballistics can be useful to him. The target competitor has to know what adjustments to make to his sights so as to be able to get on the target at the various ranges usual in competitions: once on the target it is a simple matter for him to adjust his sights to bring the centre of the group into the centre of the ten-ring. But he has no difficulty in getting to know from his fellows how many "clicks" to allow or minutes of elevation for service or small-bore rifles; and these data, once learned or noted, can amount to all the ballistic knowledge he needs.

For example, to alter the sight adjustment of my ·22 B.S.A. 12/15 target rifle from 25 yards to 50 yards, I have to bring up the backsight eight quarter-minute clicks; and to alter the adjustment from 25 yards to 100 yards I have to raise the backsight thirty-eight quarter-minute clicks. Table 3 gives the number of minutes elevation that the sights of *service* rifles (using Mark VII ammunition) have to be raised above a zero range of 200 yards.

The sportsman has a different problem. Whereas sporting rifles are often fitted with a number of flick-up leaf, open backsights marked with the ranges to which they apply, the most

satisfactory way of using the sights of a sporting rifle is to do away with the various folding leaves, have one fixed adjustment and allow for bullet-drop by shooting above or below the mark at different ranges. In this way the sportsman gets to know his rifle and almost instinctively makes the correct allowance, and thereby avoids the only too common error of over-estimating the range, flicking up a long-range sight, and shooting over the top of the game.

The majority of shots at game are taken at comparatively short ranges. Moreover, most modern sporting rifles have very flat trajectories, so that if the sights are set to give a dead-on hit at not too long a distance, the maximum rise of the bullet above the line of sight approximately half that range can be negligible. Thus, a rifle can be sighted so that practically no allowance has to be made for bullet-drop for the greater number of shots taken; for extra long-range shots the shooter has to shoot over the mark.

The line of sight is above the centre-line of the barrel by about three-quarter inch for iron sights and somewhat more for telescopic sights. The trajectory of a bullet rises from below the line of sight, coincides with it at a point, rises above it, then, as the bullet-drop increases, coincides with it at the point of aim for which the sights were adjusted, and from then on falls below it with increasing rapidity. From the muzzle of the rifle to the first point of coincidence the degree of error is always less than the distance of the sight from the centre of the rifle barrel. Between the points of coincidence the maximum degree of error occurs at about half-range, and beyond the final point of coincidence the rifleman can shoot for only a comparatively short distance farther without having to "hold over". The maximum degree of error for any particular range depends on the flatness of the trajectory, which is governed by muzzle velocity and ballistic coefficient of the bullet.

What happens is illustrated in fig. 2. Suppose R_2 represents a range of one hundred yards and that the sights are adjusted so that the trajectory and line of sight coincide at this distance. The point of aim and the point that the bullet hits are then the same, and are the amount of the bullet-drop B_2 below the line in which the barrel is pointing.

It will be seen from the diagram that the trajectory curve rises above a straight line drawn between the barrel and the point

TABLE 2 STANDARD BALLISTICS OF KYNOCH CENTRAL-FIRE METALLIC CARTRIDGES
(By permission of Imperial Chemical Industries Ltd.)

Cartridge	Bullet weight, grains	Barrel length, ins.	Ballistic coefficient	Muzzle velocity f./s.	100 yds. velocity f./s.	Muzzle energy ft.-lb.	100 yds. energy ft.-lb.	Maximum height of trajectory (ins.) over: 50 yds.	100 yds.	200 yds.
22 Hornet	45	29	0·08*	2,500	1,905	625	365	—	0·8	4·2
·297/230" Short (Morris)	37	26	0 08	875	715	63	42	1·6	6·9	—
·297/230" Long (Morris)	37	27½	0 08	1,200	915	118	69	0·0	4·1	—
·240" Flanged Nitro Express (Holland)	100	28	0·20*	2,775	2,515	1,710	1,405	—	0·6	2·7
·240" Belted Rimless Nitro Express (Holland)	100	28	0·20*	2,900	2,640	1,870	1,550	—	0·5	2·4
·240" Belted Rimless Nitro Express (Holland)	75	28	0·19*	3,500	3,205	2,035	1,710	—	0·4	1·7
6·35 mm. (·25") Auto Pistol	50	2	0·10	750	635	63	45	2 1	9·2	—
·297/·250" Rook Rifle	56	27	0·10	1,150	940	165	110	0·9	4·1	—
6·5 mm. (·256") Mannlicher (Dutch)	160	31	0·19*	2,350	2,085	1,960	1,550	—	0·9	4·0
6·5 mm. (·256") Mannlicher-Schonauer	160	28½	0·19*	2,300	2,035	1,880	1,475	—	0·9	4·2
6·5 mm. (·256") Mauser (Portuguese)	155	29	0 24*	2,400	2,190	1,980	1,650	—	0·8	3·5
·256" Magnum (Gibbs)	145	28	0 28*	2,600	2,415	2,180	1,880	—	0·7	3·0
·275" Belted Rimless Magnum Nitro Express (Holland)	160	28	0·27*	2,675	2,480	2,540	2,180	—	0·6	2·8
·275" Rimless (Rigby)	140	28	0·25*	2,750	2,540	2,350	2,010	—	0·6	2·7
" "	173	28	0·26*	2,400	2,200	2,215	1,860	—	0·8	3·6
7 mm. (·276") Mauser (Spanish)	173	29	0 26*	2,300	2,100	2,035	1,700	—	0·9	3·9
" " "	140	29	0·25*	2,900	2,690	2,615	2,250	—	0 5	2·4
7 mm. Magnum (Rigby)	140	29½	0·25*	2,675	2,470	2,220	1,895	—	0 6	2·8
7 mm. Magnum Flanged (Holland)	140	29	0·25*	2,600	2,395	2,100	1,780	—	0·7	3·1
·280" Flanged Nitro Express	160	28	0·24*	2,600	2,385	2,400	2,030	—	0·7	3·0
" " "	140	28	0·21*	2,800	2,555	2,440	2,030	—	0·6	2·7
" " " "	180	28	0·30*	2,425	2,255	2,350	2,030	—	0·8	3·4
·280" Rimless Nitro Express (Ross)	160	28	0·24*	2,700	2,485	2,600	2,200	—	0·6	2·8
" " " "	140	28	0·21*	2,900	2,655	2,610	2,190	—	0 6	2·5
" " " " "	180	28	0·30	2,525	2,355	2,550	2,210	—	0·7	3·1
Super ·30" Magnum Flanged (Holland)	150	28	0·20*	2,875	2,620	2,750	2,285	—	0·6	2·5
" " " "	180	28	0·23	2,575	2,350	2,650	2,210	—	0·7	3·1
" " " "	220	28	0·29*	2,250	2,075	2,470	2,100	—	0·9	4·0

Super ·30" Magnum Rimless (Holland)	150	28	0·20*	3,000	2,745	3,000	2,500	—	0·5	2·2
" " " "	180	28	0·23*	2,700	2,475	2,915	2,450	—	0 6	2·8
" " " "	220	28	0 29*	2,350	2,175	2,700	2,300	—	0 8	3·7
·30" (7·63 mm.) Mauser Auto Pistol	85	5½	0·10	1,400	1,035	370	202	0·7	3·1	—
·300" (·295") Rook Rifle	80	27½	0·10	1,100	915	215	150	1·0	4·3	—
·300" Sherwood	140	27½	0·19	1,400	1,155	610	415	0·6	2 7	—
·30" Flanged Nitro Express (Purdey)	150	30	0·19*	2,700	2,435	2,430	1,980	—	0·7	3 0
·30" Rimless (Springfield '06)	220	26	0 27*	2,200	2,010	2,360	1,980	—	1·0	4·3
" "	180	26	0·25*	2,700	2,495	2,915	2,485	—	0·6	2·7
" "	150	26	0 19*	2,800	2,530	2,610	2,130	—	0 6	2·7
·30–30" Winchester	170	20	0·20*	1,950	1,705	1,440	1,100	—	1 3	6·0
7·65 mm. (·32") Auto Pistol, or ·30" Browning Pistol	72	3½	0·09	925	765	135	93	1·4	6·3	—
7·65 mm. Parabellum Auto Pistol	92	5	0 12	1,200	985	295	200	1·0	4 2	—
·303" British (Mark VI)	215	25	0·25*	2,050	1,855	2,000	1,690	—	1·1	5·0
·303" British	192	25	0·24*	2,200	1,990	2,065	1,690	—	1·0	4·4
·303" British (Mark VII)	174	25	0·26*	2,450	2,255	2,315	1,960	—	0·8	3·4
·303" British	150	25	0 22*	2,700	2,465	2,430	2,025	—	0 6	2·9
·303" Savage	180	22	0 16*	1,975	1,680	1,560	1,130	—	1·3	6·1
·310" Cadet (Greener)	120	26	0 14	1,200	1,010	385	270	0·8	3·6	—
7·9 mm. (·311") Mauser (German)	227	29	0·23*	2,075	1,855	2,170	1,740	—	1 1	5·0
" " "	154	29	0·20*	2,875	2,610	2,830	2,340	—	0·6	2·5
8 mm. (·315") Mannlicher (Austrian, Bulgarian and Greek)	244	30	0 23*	2,100	1,885	2,390	1,920	—	1 1	4·9
8 mm. (·315") Mannlicher-Schonauer	200	20	0·21*	2,200	1,960	2,150	1,700	—	1·0	4·5
·318" Rimless Nitro Express	250	28	0 26*	2,400	2,190	3,200	2,660	—	0·8	3 6
" " "	180	28	0 20*	2,700	2,445	2,900	2,380	—	0·7	2 9
·32" S. & W. Revolver	85	3	0 10	600	505	68	48	3·3	14·4	—
·32" S. & W. Long Revolver	98	3½	0 12	700	610	105	81	2·4	10·4	—
·320" Revolver	80	3	0 10	550	465	54	38	3·9	17·1	—
·32" (·32–20") Winchester	115	28	0 15	1,400	1,115	500	315	0·6	2·8	—
·32–40" Marlin and Winchester	165	26	0·18*	1,650	1,400	1,000	720	—	1·9	8·9
·333" Rimless Nitro Express	300	28	0·32*	2,200	2,040	3,220	2,765	—	1·0	4·2
" " "	250	28	0·30*	2,500	2,330	3,480	3,010	—	0 7	3·2
·35" Winchester	250	24	0 23*	2,200	1,980	2,690	2,180	—	1·0	4·5
·400/·350" Flanged Nitro Express	310	24	0 31*	2,000	1,840	2,750	2,335	—	1·2	5·1
·350" No. 2 Nitro Express (Rigby)	225	24	0·23*	2,600	2,380	3,380	2,820	—	0 7	3·1
·350" Magnum (Rigby)	225	24	0·23*	2,600	2,380	3,380	2,820	—	0·7	3·1

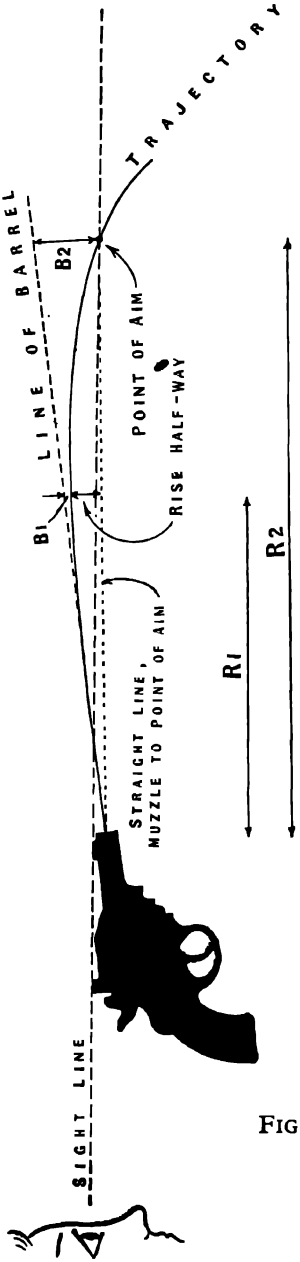
* Ballistic coefficient for the *Textbook of Small Arms*, 1929; others for *Ballistic Tables*, 1909

TABLE 2 STANDARD BALLISTICS OF KYNOCH CENTRAL-FIRE METALLIC CARTRIDGES—*contd.*
(By permission of Imperial Chemical Industries Ltd.)

Cartridge	Bullet weight, grains	Barrel length, ins.	Ballistic coefficient	Muzzle velocity f./s.	100 yds. velocity f./s.	Muzzle energy ft.-lb.	100 yds. energy ft.-lb.	Maximum height of trajectory (ins.) over: 50 yds.	100 yds.	200 yds.
·351" Winchester Self-loading	180	20	0·15*	1,800	1,495	1,300	895	—	1·6	7·8
9 mm. Parabellum Auto Pistol	124	4	0·12	1,100	935	335	240	1·0	4·2	—
9 mm. Mannlicher-Schonauer	245	22½	0·23*	2,100	1,880	2,400	1,920	—	1·1	4·9
9 mm. Mauser	245	24	0·23*	2,150	1,925	2,515	2,015	—	1·0	4·7
·360" Nitro Express	300	29	0·26*	1,650	1,480	1,810	1,460	—	1·8	8·0
·360" Nitro for Black Powder Express	190	29	0·15*	1,650	1,355	1,150	775	—	1·9	9·5
9·3 mm. Mauser	285	24	0·21*	2,250	2,010	3,200	2,550	—	1·0	4·3
·369" Nitro Express (Purdey)	270	31	0·24*	2,525	2,310	3,815	3,210	—	0·7	3·2
9·5 mm. Mannlicher-Schonauer	270	25	0·21*	2,150	1,915	2,770	2,200	—	1·0	4·7
·375" Rimless Nitro Express	270	25	0·21*	2,100	1,870	2,640	2,090	—	1·1	4·9
·375" Flanged Nitro Express	270	25	0·21*	1,975	1,750	2,340	1,840	—	1·2	5·6
·400/·375" Nitro Express (Holland)	270	28	0·24*	2,175	1,965	2,840	2,310	—	1·0	4·5
·375" Flanged Magnum Nitro Express (Holland)	300	28	0·24*	2,425	2,215	3,910	3,260	—	0·8	3·5
·375" Flanged Magnum Nitro Express (Holland)	270	28	0·24*	2,600	2,385	4,060	3,410	—	0·7	3·0
·375" Flanged Magnum Nitro Express (Holland)	235	28	0·22*	2,750	2,515	3,930	3,285	—	0·6	2·7
·375" Belted Rimless Magnum Nitro Express (Holland)	300	28	0·24*	2,500	2,290	4,150	3,490	—	0·8	3·3
·375" Belted Rimless Magnum Nitro Express (Holland)	270	28	0·24*	2,650	2,435	4,210	3,550	—	0·7	2·9
·375" Belted Rimless Magnum Nitro Express (Holland)	235	28	0·22*	2,800	2,565	4,070	3,410	—	0·6	2·6
·38" S. & W. Revolver	145	4	0·13	625	550	125	97	2·9	12·6	—
·38–200" or ·380" Mk. I (for Mk. IV Revolver)	200	5	0·16	600	540	160	130	3·1	13·3	—
·38" S. & W. "Special"	158	6½	0·14	875	780	270	215	1·5	6·3	—
·380" Revolver	124	4	0·10	625	530	110	78	3·0	13·1	—
·380" Long Rifle	124	26½	0·10	1,050	885	305	215	1·1	4·7	—
·380" Auto Hammerless Pistol or ·380" Auto Webley or 9 mm. Short Auto Pistol	95	4½	0·08	850	705	150	105	1·6	7·2	—

·38" Auto Pistol	130	6	0·10	1,100	915	350	240	1 0	4·3	—
·400" Nitro for Black Powder Express 3" (Purdey)	230	26½	0·13*	2,050	1,685	2,150	1,455	—	1·3	6·1
·450/·400" Nitro Express 3"	400	30	0·28*	2,125	1,945	4,010	3,360	—	1·0	4·6
·450/·400" Magnum Nitro Express 3¼"	400	26	0 28*	2,150	1,970	4,110	3,440	—	1 0	4·6
·401" Winchester Self-loading	200	20	0·12*	2,125	1,705	2,010	1,290	—	1·2	6·1
·404" Rimless Nitro Express	400	28	0·26*	2,125	1,925	4,010	3,285	—	1·0	4·7
·405" Winchester	300	24	0·21*	2,200	1,960	3,230	2,560	—	1·0	4·5
·416" Rigby	400	26	0·27*	2,300	2,110	4,700	3,950	—	0·9	3·9
"	410	26	0·27*	2,300	2,110	4,810	4,050	—	0·9	3·9
10·75 mm. (·423") Mauser	347	24	0·22*	2,175	1,945	3,650	2,910	—	1 0	4·6
·425" Nitro Express (Westley Richards)	410	28	0·27*	2,300	2,110	4,820	4,060	—	0 9	3·9
·44–40" Winchester	200	24	0 12	1,300	1,025	750	465	0 7	3·4	—
·45" Colt Auto Pistol	200	5	0·11	870	755	335	250	1 5	6·6	—
·45" Colt Auto Pistol (U.S.A.)	230	5	0 14	800	710	325	260	1 8	7·7	—
·450" Revolver	225	6	0·13	700	615	245	190	2 3	10·0	—
·450" Nitro Express	480	28	0·42	2,150	1,960	4,930	4,100	—	1·0	4·5
·450" No. 2 Nitro Express	480	28	0·42	2,175	1,985	5,050	4,200	—	1·0	4·4
·577/·450" Solid Martini-Henry, Black Powder	480	33	0·29	1,350	1,195	1,945	1,520	—	2·7	12 0
·577/·450" Solid Martini-Henry Black Powder	325	33	0·21	1,600	1,320	1,850	1,255	—	2·0	9 9
·577/·450" Solid Martini-Henry Cordite	480	33	0 29	1,350	1,195	1,945	1,520	—	2·7	12·0
·577/·450" Solid Martini-Henry Cordite	370	33	0·26	1,425	1,235	1,665	1,250	—	2·5	11·3
·455" Revolver	265	6	0·15	600	540	210	170	3 2	13·4	—
·455" Webley Self-loading Pistol	224	5	0·13	700	615	245	185	2·4	10·2	—
·500/·465" Nitro Express	480	28	0·29	2,150	1,875	4,930	3,750	—	1·1	4·9
·470" Nitro Express	500	31	0·39	2,125	1,925	5,010	4,100	—	1·0	4·7
·475" No. 2 Nitro Express	480	28	0·37	2,200	1,985	5,170	4,200	—	1·0	4·4
·475" No. 2 Nitro Express (for Jeffery rifles)	500	28	0·30	2,120	1,860	5,000	3,850	—	1·1	5·0
·500" Nitro Express 3"	570	28	0·39	2,150	1,950	5,850	4,800	—	1·0	4·6
·500" Nitro for Black Powder Express 3"	440	28	0·25	1,900	1,615	3,530	2,560	—	1·4	6·6
·505" Gibbs Magnum	525	26	0·30	2,300	2,030	6,180	4,800	—	0·9	4·2
·577" Solid Snider	480	36	0 14	1,250	1,035	1,660	1,140	—	3·4	16 2
·577" Nitro Express 3"	750	28	0·30	2,050	1,795	7,010	5,380	—	1·2	5·4
·600" Nitro Express (Powder charge 100 grains)	900	28	0·26	1,850	1,580	6,840	5,010	—	1 5	6 9
·600" Nitro Express (Powder charge 110 grains)	900	28	0 26	1,950	1,665	7,600	5,550	—	1·3	6·2

* Ballistic coefficient for the *Texbook of Small Arms*, 1929; others for *Ballistic Tables*, 1909



of aim. The rise of the trajectory reaches a maximum at about half-way, and accordingly this figure is mentioned in trajectory tables as maximum height of trajectory over range. Its importance is that it is an indication of the flatness of the trajectory. This maximum rise over range at half-distance is one-half the bullet-drop at full range less the bullet-drop at half-range, or:

$$\frac{B_2}{2} - B_1$$

If the line of sight coincided with a straight line drawn from the muzzle to the point of aim, the rise half-way would be the same as the amount of error in aim when shooting at the range R_1 with sights adjusted for range R_2. But as the sights are above the centre of the barrel this error is considerably reduced, and, in fact, at range R_1 in the example shown in fig. 2 is less than half the rise half-way. It will be seen that the maximum error is in this instance close to the muzzle. At approximately one quarter of the range for which the sights are adjusted there is no error, and from there on the error is slight. There is thus an advantage in the sights being above the axis of the barrel, and there is an optimum height for the sights that give the minimum error over the range. The effect of fitting telescopic sights, which are generally higher than iron sights, is somewhat to increase the

FIG. 2. Sight Line and Trajectory.

TABLE 3

Range in yards	S.M.L.E. (No. 1) and (No. 4) Mark I rifles	Enfield Pattern '14 (No. 3) rifle
200	0 mins. elev.	0 mins. elev.
300	3 "	3 "
400	6½ "	6½ "
500	11 "	11 "
600	16 "	16½ "
700	21½ "	22½ "
800	27½ "	29½ "
900	34½ "	37½ "
1,000	42½ "	46½ "
1,100	51½ "	57 "
1,200	61½ "	68½ "

range over which the rifle can be used without sight adjustment. It is, however, usual to arrange sights as low down on the top of the barrel as possible to avoid the need of a high cheek piece or comb to make the rifle fit properly.

For different classes of game shooting, different curves of trajectory are applicable. A low velocity and curved trajectory are satisfactory for shooting large animals at short range. For shooting small animals at comparatively long range the bullet rise above the line of sight must not be great, or a clean miss may result: consequently a high velocity is needed, though a light bullet of comparatively poor ballistic coefficient will suffice. A high value of ballistic coefficient becomes of importance only when shooting is at long range.

Velocity and energy of impact are little reduced over short ranges even if the ballistic coefficient is not particularly good. But for long-range shooting without excessive bullet-drop or loss of energy a good ballistic coefficient is essential.

This is where some knowledge of ballistics comes in useful. A sportsman selecting a rifle to use against a particular kind of game has first to choose, in effect, a suitable cartridge and bullet, and then buy the rifle to take it. The cartridge must have sufficient power to kill the game but not be so powerful as to utterly destroy it. The bullet must be so designed as to penetrate and effectively transmit the whole of its energy to the game but not go right through and waste its energy on the background. The trajectory must be such that a shot aimed at a vital part will hit that vital part at any reasonable range with no more than a little allowance having to be made for distance.

Chapter 7

Rifle components—The stock—An accident—Barrel bedding—Actions—Safeties—Trigger adjusting—Hair triggers

A BREECH-LOADING rifle consists of the barrel, the action and the stock. The action is that part of the mechanism which closes the breech and contains the lock by which the cartridge is fired. In the case of bolt actions, rising block actions, etc., the barrel is very firmly screwed into the action body, the direction of the thread being such that the reaction of the spin of the bullet will tend to tighten up—not loosen—the barrel from the action. Double-barrelled rifles are constructed on the same lines as a shotgun, and have barrels which are not permanently fixed.

At the breech end of the barrel is the chamber which is made with minute accuracy so as to take the cartridge exactly, without tightness or undue slackness. Too tight a chamber can cause excessive pressure: too large a chamber may lead to splitting of the cartridge, gas escape, and difficulty of extraction of the fired case. It can also greatly affect accuracy.

Immediately in front of the chamber is the lead, a taper which leads the bullet from the smooth-bored chamber into the rifled barrel. In ideal conditions, when the cartridge is in position ready for firing, the bullet projects into the lead and the "ogive", or arched nose, rests in contact with the lands of the rifling.

Before chambering, the barrel of the rifle is drilled, then bored to accurate diameter, after which the spiral rifling is cut in a series of operations, the depth of the grooves being increased until the required depth is attained. This leaves the grooves and the lands between them rough, so that before the barrel is complete it has to be lapped to a smooth surface. Lapping is done by casting inside the barrel and on to the end of a rod a lead lap, which is moved backwards and forwards after a fine abrasive has been applied to it. When the lapping is finished

the barrel should be smooth and of even diameter throughout its length to a minute degree of accuracy.

The stock is attached to the barrel and to the action body by means of screws, or bands and screws. There are two kinds of stock: the one-piece stock and the two-piece stock. The former extends in one piece from the butt-plate to the tip of the fore-end and is attached to both barrel and action body. A two-piece stock consists of a separate fore-end attached to the barrel, and a separate butt attached to the action body, either by screws passed through "straps" which are part of the action body or by a bolt screwed in from the rear. Military rifles have additional pieces of wood known as handguards, the purpose of which is to prevent the soldier from burning his hands on a hot barrel.

One often sees in American writings the remark that one-piece stocks are better for accuracy than two-piece stocks, because they are more firmly fixed to the metal parts of the rifle. There may be something in this in exceptional circumstances, but a two-piece stock can be entirely satisfactory. The B.S.A. target rifle is an excellent example of this. Here the semi-floating fore-end is firmly attached to the barrel by one screw, and the butt is secured to the action body by a strong bolt tightly screwed right through from a recess under the butt-plate.

The important thing, from the point of view of accuracy, is not whether the stock is in one piece or two but whether it is properly fitted. Very expensive rifles have their barrels perfectly bedded, but mass-produced rifles are not always as accurate as they might be until the owner or a gunmaker has re-bedded the barrel to the stock. This can be done by expert fitting: but the judicious use of paper, plastic wood or other suitable packing material is usually sufficient to ensure perfect contact between barrel and stock. A certain amount of experiment is sometimes necessary before the best results are obtained. Competition rules recognize the necessity for barrel-bedding and permit this to be done, within certain limits, to the various service rifles used in competition.

The fore-end is that part of the stock which extends forward from the trigger guard. Behind the trigger guard come the hand (that part which is gripped by the right hand during shooting) and the butt. The top edge of the butt is called the comb; the top rearmost corner, the bump; the bottom corner, the toe. The

rear end of the butt is covered by the butt-plate, which may contain a trap for holding such things as the oil-can and pull-through. Many hands are curved downwards in the shape of the grip of a pistol, and are then called pistol grips. In expensive rifles these terminate with a pistol-grip cap containing a trap which is often used for storing spare foresight blades or beads.

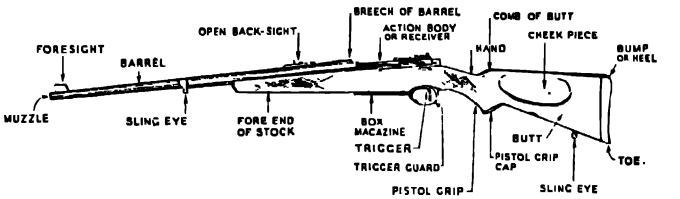


FIG. 3. Component Parts of a Rifle.

Americans have a different nomenclature for some of the parts mentioned. For example, they talk of the "rear sight" instead of the "backsight"; the "receiver" instead of the "action body"; the "grip" instead of the "hand"; and the "heel" instead of the bump. These terms are important, because some of them are coming into general use in Britain and elsewhere.

The fashion in fore-ends has changed. Early in the century they were small and short, and more ornamental than useful. Now it is appreciated that a fore-end should be large to rest well in the hand of the shooter, and that it should be long. In most shooting positions, target or sporting, the left hand is now carried well forward, as it is when using a shotgun. But whereas the shotgun shooter is content to take hold of the barrel, this does not do for the rifleman. And so we have the large "beaver tail" American sporting fore-end, not unlike the fore-ends of target rifles as now used in all countries.

The preferred material for gunstocks is walnut, because it can be worked easily, has a good appearance when finished and does not warp much. For good quality shotguns and rifles of English make, French walnut from a region in the south of France near Italy is used, this being considered the best obtainable for the purpose. The stocks are bought in the form of "blanks", roughly shaped and priced according to quality. The blanks are seasoned for a long time until they cease to lose weight, and are then selected for weight, grain, etc.

In selecting a rifle or gun from stock, as for example when buying a mass-produced weapon, you should look at the grain of the stock to make sure that it runs through the hand in such a way that there is little chance of the stock breaking at this, its weakest point. An ideal grain is one which runs parallel with the underside of the butt, curves slightly through the hand, and continues straight along the fore-end.

Curl in the grain is very attractive as an ornament, but it should be confined to the thick part of the butt, where strength is not lacking: elsewhere the grain should be straight.

I once bought a rifle that had fiddle-back grain running right from the tip of the fore-end to the bump of the butt, including right through the hand. I selected it from a group of mass-produced weapons for the reason that it looked attractive. I fitted it with a different sight from that provided, took it on to the range and shot it in, and in due course it went into the field. We had some days of rain and sunshine that made short work of the thin varnish finish, so that when I got home I decided to take off what remained of the varnish and hand polish with oil. It was then I discovered a crack in the hand going deep into the wood, suggesting that with any further usage the butt would snap right off. I thought at first that this would mean the expense of re-stocking—an unattractive prospect. But on further reflection I decided to do the repair myself.

With a rasp I cut out as much as I dare of the split woodwork, then built it up again with mahogany plastic wood, carefully smoothing it over with fine sandpaper. (I chose mahogany plastic wood because it matched for colour better than the walnut variety.)

Then I drilled a hole through the centre of the hand from behind the end of the pistol grip until it almost reached the bolt that secured the trigger guard to the action body. Into this I screwed a $\frac{5}{16}$-inch steel rod with a fine thread, first coating it with celluloid solution. When the rod was right home I cut it off, shaped up the end to the shape of the woodwork, blued the exposed metal, and re-polished the wood and plastic wood with oil.

The stock has given no further trouble, and the tiny crack, still visible, has not extended. But I have learnt my lesson, and am not likely again to be tempted by an attractive grain that does not run in the right direction.

The fixing of the stock and, in particular, the bedding of the barrel to the fore-end, is of great importance to accuracy. When a rifle is fired, the shock of the explosion causes the barrel to bend sufficiently to deflect the bullet considerably from the course it would otherwise take. This bending of the barrel, known as "barrel flip", does not matter if it is always the same and always produces the same deflection of the course of the bullet. But if the barrel is not perfectly bedded so that when it flips it hits the fore-end in a different way each time, it is impossible to predict what course the bullet will take or make allowance for it in the adjustment of the sights.

Target rifles in which great accuracy is required are fitted with heavy barrels which, besides being easier to hold steady, do not bend much. They also have arrangements for barrel-bedding that ensure consistent performance. Very expensive rifles, such as best-quality rifles for game shooting, have their barrels bedded into the woodwork by careful handwork. The metal is let into the wood bit by bit and tried by the application of lamp-black, so that when the work is finished there is a perfect contact between metal and wood in those places where contact is required.

Such expensive work is, of course, out of the question in the manufacture of mass-produced target rifles which have to be within the purchasing power of all classes. In such case consistent performance is secured in the design. If the fore-end cannot be bedded perfectly at reasonable cost, it can be prevented from interfering with barrel flip by having little or no contact with the barrel. A fore-end fixed to the action body and having no contact at all with the barrel is called a "floating fore-end". Present-day B.S.A. target rifles have semi-floating fore-ends, *i.e.* the fore-end is fixed to the barrel at one point, where it is securely bedded and held by a screw; whereas the rest of the fore-end is clear of the barrel by a space sufficient to permit a postcard to be passed freely between it and the barrel.

Another method is to secure the fore-end with a screw some inches from the action body and permit further contact with the barrel at the tip. At this point a band may be provided to hold the fore-end in position. Many target men bed the fore-ends of their small-bore rifles in a non-drying mastic composition, or on a layer of felt.

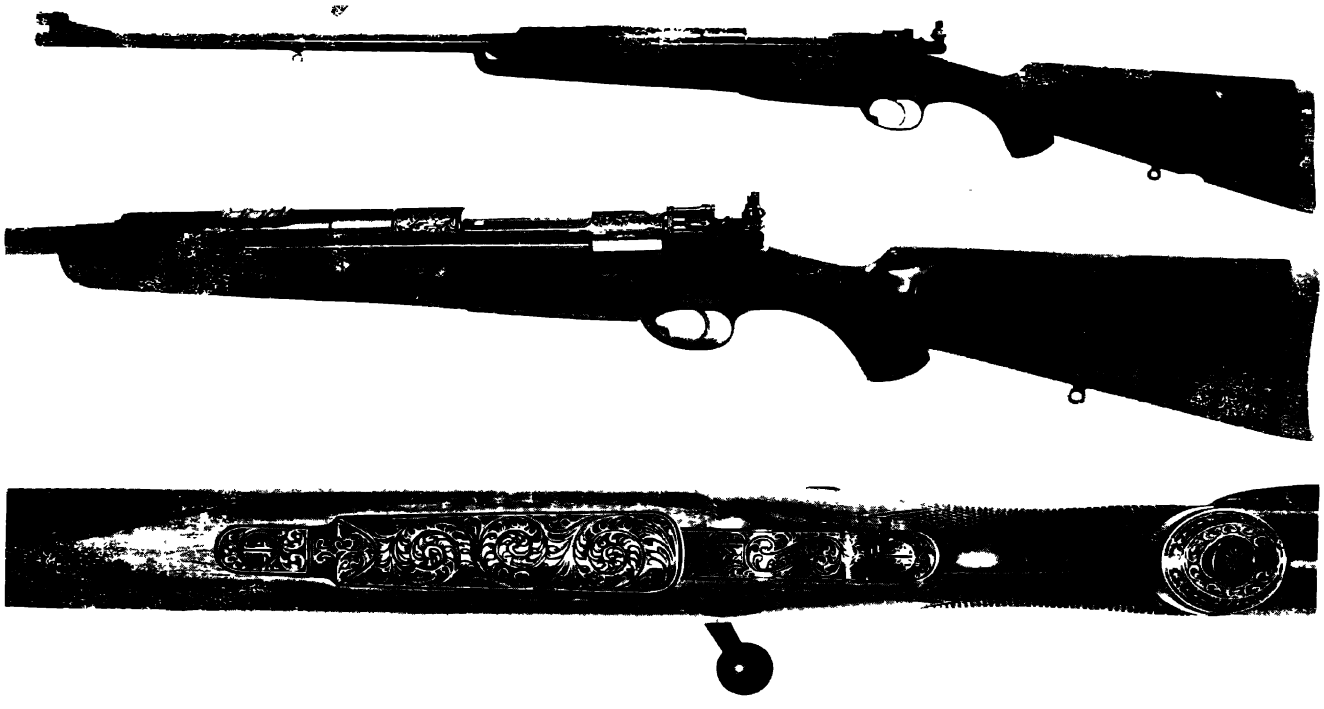


Plate VIII. Cogswell & Harrison Model de Luxe Rifle. Calibres: 7 m m. ·275 Magnum, 30 '06 Spring-field, ·300 Magnum, ·318 Express, 9·3 m m Mauser, 9·5 m m Nitro Express, ·375 Magnum and ·404 Nitro Express

Plate IX. Holland & Holland ·375 Magnum Magazine Rifle, Holland & Holland ·240 "Apex" Royal Hammerless Ejector Rifle and Holland & Holland ·465 Royal Hammerless Ejector Rifle.

Rifles are classed as single-shot and repeating. Those in the former class are loaded by hand every time a shot has to be fired. The latter class includes magazine rifles and semi-automatic or self-loading rifles.

Single-shot rifles include all small-bore target rifles and many used for sporting purposes. Several types of action are used. These include falling-block actions actuated by a lever, such as the Martini (much favoured by English small-bore target men), the old English (or Scottish!) Farquharson action; and many American patterns. In most of these a block of metal supported against shoulders, or on a pin, is moved by a lever to expose the breech. At the same time the extractor flicks out the cartridge, and the firing mechanism is either cocked or half-cocked according to whether the weapon is hammerless or not. On the lever being returned to its original position, the breech is closed and, in the case of hammerless weapons, the rifle is ready for firing. Those with hammers are usually only half-cocked, and the hammer has to be drawn back with the thumb from half-cock to full-cock before the rifle can be fired.

Double-barrelled and some single-barrelled rifles are made on the same lines as a shotgun. A lever is pressed so that the barrels can be dropped down, exposing the breech, while the extractors push out the cartridge or cartridges. On lifting the butt to bring it into line with the barrel, the mechanism automatically locks. Again, the hammerless weapons are automatically cocked during the process, whereas those with exposed hammers have to be cocked before firing.

These weapons, which could be said to be of traditional design because they retain many characteristics that can be found in old cap-and-ball or even flint-lock guns, are classed like shotguns according to the type of action. They are mostly "hammerless": in fact, I do not think a hammer rifle of this type has been made for many years. They have bar-action and back-action side-locks and box-locks of Anson and Deeley or modified design.

Rifles that break down for loading like a shotgun were made to a much greater extent formerly than at present. The design was favoured for the big-game double-barrelled rifle, and also for smaller calibres, including the single-barrelled rook-and-rabbit rifle, which was used by countrymen until the superior rimfire cartridge rendered the old rook-and-rabbit cartridges obsolescent.

At the present time very nearly the only rifles made on the break-down principles are the big-game doubles, which are still the favourite weapon of many hunters of dangerous game who can afford to pay the price. But a best-quality double can cost over five hundred pounds, and this in itself is sufficient to make many a sportsman decide on having magazine rifles only.

Of repeating rifles, the bolt action is becoming more and more popular. It is based on the original Mauser design, but has been modified in various ways by improvements or adaptations to different types of cartridge. Until the advent of automatic weapons the bolt action was generally favoured for military purposes and is still in use, although no doubt it will soon be replaced by the semi-automatic and fully automatic rifles that are now being adopted by all countries.

However, bolt actions have been found excellent for all types of game shooting, for they can be very strong, capable of withstanding high pressures; very reliable; suitable for mass-production manufacture; and easy to take down or repair without the need for special tools.

One of the requirements of high accuracy is that the cartridge shall be held in such a way that it cannot move or transmit a vibration to the mechanism of the action when it is fired. For this reason an action which consists of solid metal and locks very close to the breech, such as some bolt actions and the old Farquharson action, are best for super-accurate rifles. Some American authorities state that the bolt action is best for rimfire target rifles because it locks close to the breech. The Martini, they say, because it is held by a bearing surface at the rear of the block, cannot be so accurate. In the circumstances it is odd that one of the best-known American *bolt-action* small-bore target rifles is not locked close to the breech but several inches to the rear. Furthermore the metal in the bolt is much lighter than that which makes up the block of an English Martini.

There are several very different patterns of bolt action suitable for different kinds of shooting or weights of cartridge. The original Mauser, the modern Mausers and magnum actions which are very largely used in the making of hand-made English magazine sporting rifles, and various modifications based on the Mauser design, have locking lugs very close to the breech. These are usually strong actions, suitable for powerful cartridges

and good for accuracy. But they have one serious objection for military purposes in that the grooves that engage the locking lugs are difficult to get at for cleaning purposes, and if they get fouled with mud or sand they can put the rifle out of action for a considerable time.

Some military rifles such as the Short-magazine Lee-Enfield and some small-bore target and sporting rifles have locking lugs at the rear, but the way in which these lugs are arranged varies considerably with the design and the quality of the job. The fact is that a bolt-action rifle can be almost any sort of rifle from the first-quality sporting weapon, capable of being used with powerful cartridges developing great pressures, to the lowest priced toy-like sporting rimfire ·22.

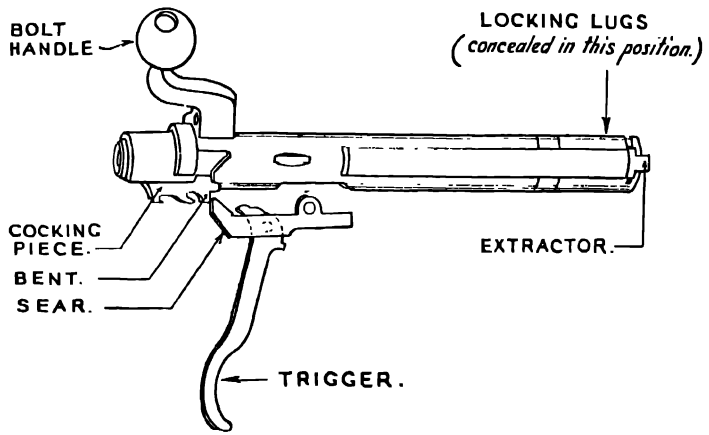


FIG. 4. Bolt action of P.'14 Rifle, showing Engagement of Sear with Cocking Piece.

Generally the bolt of a bolt action consists of a tube of metal incorporating locking lugs. If the tube or some other part of the bolt is rotated, the lugs engage in grooves in the action body so that the bolt is locked and cannot move from the breech until it is rotated again to its original position. The bolt is usually rotated by the bolt handle, which projects to the right-hand side. In most instances it is lifted up to unlock the breech. The motion rotates the whole or part only of the bolt, according to the design.

Inside the bolt is the cocking piece, fixed to or incorporated in the striker. This is drawn back against the mainspring,

usually by the lifting of the bolt handle, and the spring is further compressed when the bolt is moved forward to close the breech, and the handle pushed down. It is at this moment that the "sear" is engaged with the "bent", and the cocking piece held back against the pressure of the mainspring, awaiting release by the trigger. In all good-quality bolt actions the bolt is so designed that accidental release of the trigger cannot fire the cartridge until the breech is properly closed by the bolt handle being pushed down—a point to be looked for when purchasing.

The triggers of bolt actions usually have a double pull—*i.e.* on a light pressure the sear is caused to move along most of its distance of travel but not quite far enough to disengage it from the bent: on a further, heavier pressure the sear moves the remaining short distance to disengage. This is a safety device to prevent the accidental disengagement of the sear during the closing of the bolt, for one of the characteristics of the bolt action is a certain amount of looseness of the bolt, except when the breech is closed.

The safety device used to prevent the accidental firing of the piece takes the form of a catch which pulls back the cocking piece, holding it out of contact with the sear. The trigger can then be pulled, but nothing will happen until the safety is disengaged. The fault of some of these safeties is that they are noisy and could disturb game at the moment before firing. Some are stiff to operate, or even a bit unhandy. However, the type used in the Zbrojovka Brno Hornet rifle can be easily moved in complete silence, and it is absolutely effective.

The main reason that the bolt action susperseded the various falling-block actions for both military and sporting purposes was that it was easy to incorporate in it a repeating device, in particular the box-magazine rifle. It was also better than the rising-block action in primary extraction because the bolt-lever and the inclined plane against which it works exert great leverage in starting out the fired cartridge case. Both the Martini and the Farquharson can give difficulty in extraction if the chamber gets dirty with sand or mud, or a cartridge expands too much in a hot climate.

Single-shot bolt-action rifles are obtainable, including those for ·22 rimfire cartridges, probably because this action is more saleable at the present time than other actions. But there does

not seem to be much virtue in using this action in a single-shot weapon, which could be made a repeater at very little additional cost.

Unlike most other actions, the bolt action is not easy to use without practice. The shooter has to learn how to draw back the bolt *the full distance* and snap it back quickly without bringing the rifle down from the shoulder. The motion is lifting the lever, drawing back, pushing forward and pressing the lever down so smoothly and rapidly that it seems to be one movement. If the bolt is not drawn fully back, it will fail to pick up a cartridge from the magazine; or a jam may occur. The shooter has to learn to bring the bolt back hard and, without stopping, return it forward. In time he will be able to do this without fail with one particular rifle, but may find that if he picks up another weapon with a different length of movement, he has to learn all over again.

Mass-produced bolt-action rifles often have "sticky" actions to begin with, because of the friction of the tool marks on the bolt against the tool marks in the action body. With use they become much easier. This, of course, does not occur in expensive high-quality products.

The correct way to use a Mauser action for sport is always to load from the magazine, not to stick a cartridge "up the spout" and close the breech on it. This should be developed as a habit.

Bolt actions take down in different ways according to their design. Special tools are occasionally needed for the removal and replacement of some parts, but, broadly, the bolt action can be taken down for cleaning or inspection without the use of any tools at all.

To take down the Zbrojovka Brno ·22, long rifle bolt action, I have only to press on a black stud at the rear end of the bolt, compressing the mainspring, and then pull out the safety lever, which is on the top. On release of the pressure everything is free, and the striker and mainspring can be withdrawn.

The bolt action of the ·22 Hornet is even easier. All one has to do is to grip it firmly, uncock the action and then pull out the bolt-lever. In this rifle the bolt-lever is a separate piece and is not held in position except when the action is half-cocked or the bolt is in the rifle. When replacing the bolt care should be taken that the extractor is properly aligned, otherwise it will

not go back. (This applies generally to bolt actions closely resembling the Mauser.)

Some owners of magazine rifles like to have spare magazines. This is good policy, for although magazines are not often lost or damaged there is always this possibility, which, to say the least, is irritating. The parts of a magazine that can go wrong are the spring, which can become weakened or broken, and the lip, which, if not well made or hardened, can become deformed so that the cartridge does not feed into the breech properly.

The old-fashioned Farquharson action is highly prized by American "varmint"-shooting enthusiasts for conversion to high-velocity small-bore cartridges. The Farquharson action has but two faults: it is very heavy, and is not too good on extraction. But its strength is immense and there are few, if any, other actions so completely safe to use with high-pressure cartridges.

The Martini action in its modern form has many points in its favour. It is simple and reliable, and because it is easily

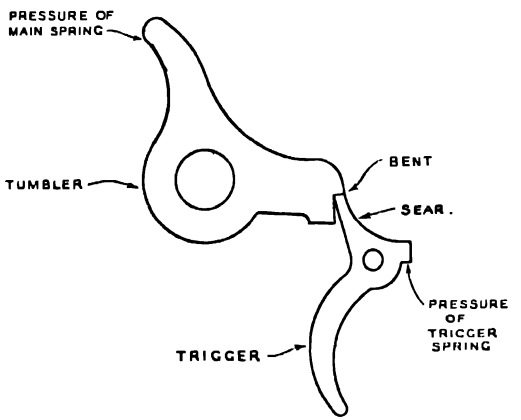


FIG. 5. Tumbler and Sear of Martini Action.

removable from the action body by the undoing of one screw it is simple to clean and adjust. It is also handy for use in the field against small game. The target Martini, however, has the drawback when used in the field that it has no safety and therefore must be carried unloaded when not held at the ready.

Old-fashioned Martinis which had not the removable action had to be cleaned from the muzzle end. Most modern Martinis

have a hole that passes right through to the rear in line with the barrel so that they can be cleaned from the breech end after the action has been taken out, thereby eliminating risk of bell-mouthing the muzzle.

When choosing an action consideration should be given to the possibility of injury should anything go wrong. In particular there is the risk of escape of gas to the rear; this, according to a record made in the United States, has been responsible for the majority of accidents with the U.S. Rifle Cal. 30, M 1903, which included a few instances of lost eyes and other serious injuries. Some actions, such as the Farquharson, are so well designed that there is no cause for worry. Bolt actions usually have gas vents to release any gas that might find its way to the rear *via* the inside of the bolt. But there are actions which are not altogether perfect in this respect. It is not easy even for an expert to assess what might happen should a cartridge fail to obturate satisfactorily. I recommend the test which I apply, which is to blow tobacco smoke down the barrel of an empty rifle and observe where it comes out. The rifle should, of course, be cleaned immediately afterwards to remove condensation.

Target rifles are occasionally fitted with a screw by which the pressure of the trigger spring can be altered, so that the trigger pull can be adjusted within limits. Sometimes rifle- or pistolmen attempt to lighten trigger weight by shortening helical mainsprings or substituting weaker springs than were put in by the makers. This is the wrong way to make trigger adjustments, for reduction of the weight of the mainspring, if excessive, can cause misfires, and even if moderate can make the performance of cartridges irregular.

The correct way to adjust the weight of the trigger is to alter the angle of contact between the sear and the bent, *i.e.* the cut in the tumbler or hammer in which the sear rests. This is a very delicate adjustment which is made by working slowly with a fine stone slip, examining the work through a powerful lens and reassembling from time to time to test the weight of the trigger.

Most sportsmen and some target men get this adjustment done by a gunsmith, but most rifle clubs have members who are quite competent to adjust the trigger weights of Martini target rifles, which usually are so designed that the parts are easily accessible. The adjustment of a bolt-action rifle is a little more tricky, for

the sear is often so arranged that its movement pushes the bolt back a little, and an injudicious attempt to alter this so as to lighten the trigger might easily make the trigger irregular and dangerously touchy. On the other hand, the face of the cocking piece where the sear engages is often quite easy to touch up and, incidentally, in the case of low-price mass-produced rifles sometimes needs attention in the first instance.

The military way of testing a trigger is with a specially designed spring balance. This method is condemned by experts as inaccurate and inconsistent, and for competition purposes triggers are always tested for compliance with the rules by the application of weights, which must be suspended at the angle laid down in the rules of the competition.

The trigger of a well-made rifle with properly hardened parts remains of constant weight for a long time. But the weight can change, and it is very annoying to go to an open meeting and not be able to shoot until a gunsmith has done something about the trigger weight and, perhaps, made the trigger overheavy or of unfamiliar feel, so that your shooting suffers. To avoid this I always weigh a trigger before going to an open competition, and in case it should become light I always take a fine carborundum slip with me, for one touch of the slip slightly roughens the surface; this sometimes makes just that alteration necessary to get the trigger past the test.

Satisfactory trigger-testing weights are quite easily made. Take a piece of $\frac{3}{16}$- or $\frac{1}{4}$-inch diameter bright mild-steel rod or wire sufficiently long to suspend the weight clear of the rifle when one end of the rod is hooked over the trigger and the rifle is held at the correct angle. Make a small hook at one end of the rod by heating and bending over in a vice; in the same way carefully crank the other end so that it passes round the hand of the rifle and back to hook over the trigger. Then get a small tin; place the hooked end of the rod in it. Pour in about an inch depth of molten lead and hold the rod vertical until the lead has set. When the lead has cooled, place the tin and its contents on a pair of scales with a weight of the required value in the opposite pan; then pour more lead into the tin until the trigger-tester is just the required weight. Finally, trim up any imperfections, paint the whole with aluminium paint, mark on the value of the weight, and recheck for accuracy. (See Plate XI.)

The minimum trigger pull of a service rifle is 5 lb., that of a match rifle 4 lb., a small-bore target rifle 3 lb., a sporting rifle used in competition 2½ lb., a military revolver 3 lb., and a ·22 pistol 2 lb. The quality of a trigger pull is crispness without drag, *i.e.* a noticeable movement before trigger release. Drag is hardly noticeable, or not at all, to a newcomer to the game, but the practised shooter is aware at once of the slightest movement of the trigger. A crisp pull-off has been described as being like the breaking of a glass rod: pressure of the finger is applied and increased until, without warning, the rifle goes off. The latest target rifles have trigger pulls that are not only crisp and free from noticeable movement before release but there is no sensible movement at all even on release! As pressure is applied the rifle fires, and yet the trigger seems to stand still without even a sensation of vibration. Such trigger pulls are very helpful towards high scores.

The hair-trigger is an arrangement by which a piece can be fired by a very light touch after some action has been taken to set the "hair". There are several types, but all may be classed under single- and double-triggers.

The single hair-trigger has to be pushed forward against the pressure of the spring to set it. It is then held in the forward position by a mechanism which releases it as soon as it is touched —and the piece is fired.

In double hair-trigger mechanisms the forward trigger (usually) releases the sear, while the rear one sets the hair. If a hair-trigger is not set, the main trigger works the sear in the ordinary way but requires a comparatively heavy pressure of the finger.

It has been complained with justification that rifles having hair-triggers often have heavy or rough trigger pulls. Where this occurs one can only assume that the maker is solely concerned with securing a satisfactorily light pull, believing that the shooter will not be interested in using the trigger in the ordinary way. This was certainly the case with one of my rifles, but some work on the mechanism finally made it crisp and reasonably light.

Such faults would not matter if it was always advantageous to use a hair-trigger, but the advantages in practical shooting are small or often negative. A hair-trigger is not the choice of everyone for shooting moving game and, while it has its points

for deliberate target shooting, it is prohibited by the rules of most competitions. Also, it can be more than a trifle dangerous.

Usually a *single* hair-trigger once set cannot be unset except by firing the piece, unless there is a safety of the kind which prevents the striker from falling. Double hair-triggers can usually be uncocked by pulling back the rear trigger, holding it and gently letting it forward, at the same time pulling the main trigger sufficiently to release the hair but not to fire the piece. If there is no safety, this procedure involves some danger of an accidental discharge. If, however, there is a safety it should be put on. Once on there is no need to carefully uncock the hair; all one needs to do is to pull the trigger, when the hair will be released, but the rifle will remain cocked owing to the interception of the safety.

Chapter 8

Drawing the long-bow—The accuracy of the rifle—Need for good sights—Iron sights—Open sights—Aperture sights —Fixing—Adjustments

RIFLES have the advantage over all earlier weapons that throw projectiles in that if pointed in the right direction they will consistently place the shot where the shooter wants it to go. A lot of nonsense has been written of the matchless skill of old-time archers such as Robin Hood. These stories have to be taken with more than a grain of salt, for no amount of skill on the part of the marksman will make up for the error inherent in the instrument. The long-bow and arrow, the cross-bow and bolt, can be used in a masterly manner: but even if shot by a machine they would not hit the same spot every time. They would produce groups varying in size according to their mechanical imperfections.

The comparative accuracy of the bow and the rifle is indicated by the targets used. The "gold", which is the bull's-eye of the archery target, is as big as a saucer. Yet it is so seldom hit that it is the custom for everyone present to pay a shilling to any bowman who hits the gold three times "off an end". It is, in fact, recorded as something to remember that Horace A. Ford, the outstanding archer, hit the gold twenty-eight times out of seventy-five shots at sixty yards.

As compared with this, a small-bore target rifleman of average club standard can hit a two-inch circle six or seven times out of ten at one hundred yards, and a "possible" of ten out of ten is the common achievement of the good shot.

Rifles, however, are not without mechanical error, and some are more defective than others. But a good rifle is capable of such extreme accuracy that if held in a mechanical rest so as to remain on aim, it will, at a range of one hundred yards, place all shots in a circle of about one-inch diameter.

To be capable of making use of this fine accuracy the shooter must be able to point the rifle very exactly. (Here, again, the

brethren of the long-bow were at a disadvantage, for not only did bows have no sights but, according to the range, the archer had to judge how much to aim above or below the mark.)

Precision of aim is achieved by lining up two sights with the point of aim. If the sights are suitably designed, a person having normally good eyesight can take full advantage of the mechanical accuracy of the rifle. Given perfect weather conditions, good shooting calls for an accurate rifle, good eyesight and the marksman's skill of perfect holding and a perfect trigger release.

The type of sights used depends on the type of shooting. Accuracy is not the only thing that matters: in some forms of sport speed in getting on aim is of almost equal importance.

At one time all sights were what are now known as "iron sights", or sometimes "metallic sights". These consist of a metal foresight, usually a blade or bead, and a metal backsight in the form of a V or a ring. But now telescopic and other "optical" sights are becoming much more commonly employed and of more real importance to the practical shooter. Nevertheless most rifles have iron sights. Nearly all are sold with them in the first instance, and, apart from certain exceptions, iron sights only are permitted in competition shooting.

Most writers on rifle shooting discuss foresights and backsights as separate entities, dealing first with the various kinds of the one, and then passing on to the other. This, I think, is wrong, for the foresight and backsight of a rifle are used together and have to be properly matched. There is a wrong and a right type of foresight for each kind of backsight, a fact which can be overlooked or not properly stressed if each of the two components is considered separately.

Iron sights are classed as "open sights" and "peep" or "aperture sights", according to whether the backsight is an open notch fixed to the barrel of the rifle or a small round hole arranged as close to the eye as practicable. Open sights are the most common equipment of sporting rifles as sold. At one time they were usual on service rifles. they still remain the only satisfactory sights for pistols. Aperture sights are invariably fitted to modern small-bore target rifles, are fitted to the more recent service rifles, and are always used in "SR(*b*)" service-rifle competitions. For many classes of game shooting they are superior to open sights, being more accurate for use at long

ranges and, in the opinion of many sportsmen, quicker on aim provided they are properly fitted.

The foresight for the open sights of a sporting rifle should generally be a circular bead as small as the individual can use. For big-game shooting at short range this is usually used with a wide obtuse V-notch backsight. When the rifle is on aim the bead should rest in the apex of the V, the whole of it showing, but the stalk that supports it completely concealed. The bead should have a flat surface facing the eye, for if it is rounded it will shine on the side nearest to the light and may cause a false aim. If you have a rounded bead, and gunmakers often issue them, you should carefully rub it down to an even flat plane, working with a fine stone slip and watching the work with a strong lens all the time.

The "caterpillar" foresight is often preferred in English sporting rifles. This is a long thin cylinder tapering slightly towards the front and supported on a knife-edge which fits longitudinally in a slot on the foresight ramp. Viewed from the

FIG. 6. "The bead, the whole bead, and nothing but the bead." Sighting with Bead Foresight and Open V Backsight.

rear it appears as a clearly defined circular bead standing on a low slender stem. The forward taper of the cylinder and its backward projection from the supporting blade make its outline clearly defined. Owing to its length it is strong, and this is an important factor in game rifles which often have to endure a good deal of knocking about.

There is some difference of opinion as to what is the best colour for a bead. Bright gold-coloured alloy is considered by some to be the best. This sounds right, but I cannot speak

from personal experience. Platinum or other white metal is sometimes used for the face of the bead, but this I do not altogether favour. A number of sportsmen have found ivory to be very good: others say that red enamel is the best.

Recently I tried pink fluorescent poster ink and found it very satisfactory. The quality of this ink is that it reflects ordinary light, and also it transforms the invisible ultra-violet rays into visible light. Thus in bright daylight it appears to glow as if it were red-hot. It adheres to clean metal reasonably well and dries with a mat surface. Its only fault is that the fluorescent property is not lasting and is destroyed if exposed daily to bright sunlight for about three weeks. However, even without its fluorescent property the bead is clearly visible; and the ink is easily replaced.

I have two sporting rifles of the same weight and general shape and fitted with similar sights. I applied pink fluorescent ink—the colour of peppermint rock—to the foresight of one and found that this showed up against any natural background. The other foresight I cleaned with a stone to a bright metal surface. Then I took the rifles to the hundred yards open-air range.

With the pink foresight I could shoot without difficulty: it showed up clearly against the black aiming mark, against the white of the target card, against the earth bank that formed the bullet-stop and against the grass and trees. But I could not see the bright metal foresight properly: it looked grey and seemed to merge with every background, and I had difficulty in distinguishing the top of its black supporting stalk from the top of the bead.

Square-topped blade foresights can be used with open sights, but the backsight must have a rectangular notch with square shoulders. With such sights the rifle is "on aim" when the top of the blade is level with the shoulders and is properly centred with just a little white of the background showing on each side of it between the sides of the notch. It is not too good for game shooting as it is slow, but it gives good accuracy on the ranges and is better than a bead and V for target purposes. It is the normal equipment for pistols, either for target or practical purposes, and when so used is known as a Patridge sight. For target shooting the foresight blade is usually blackened, and target men often carry a bit of candle with which to resmoke their foresights and make them absolutely dead-black. Here

again fluorescent ink is useful when shooting at black-silhouette pistol targets.

The chief advantage of the peep sight is that it does away with the need for the shooter to concentrate his attention on more than one sight. With open sights the shooter has to see the game, the foresight and the backsight at the same time, and with sufficient clarity to be able to line them up properly. The eye has some adaptability of focus, and the eyes, particularly of

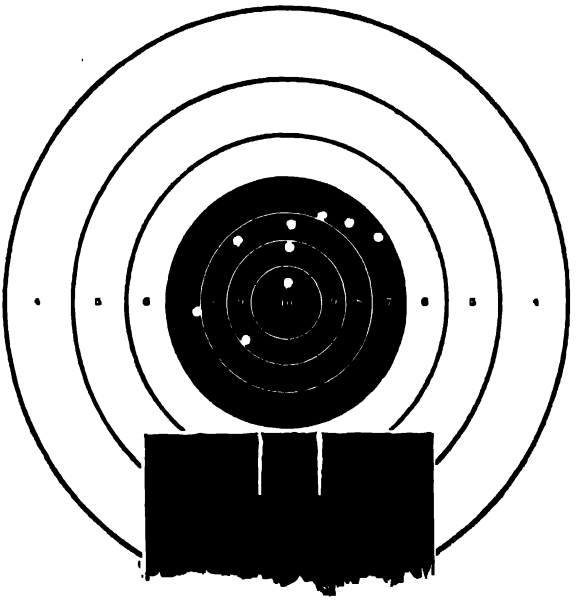


FIG. 7. Sighting with Patridge Pistol Sights.

young men, are capable of rapidly changing focus so that, although both sights and target cannot all be seen clearly at exactly the same time, they can nevertheless be lined in well enough. But the backsight is never sharply outlined—there is *what appears to be* the main outline, surrounded by a blur. And this causes error, as the position of the apparent outline varies with the intensity and direction of the light. This variation is sufficient to cause appreciable differences of aim.

With the aperture sight the shooter looks *through* the small hole in the backsight, which forms a misty ring round the

foresight. Owing to the increased length of sight base, error in positioning the backsight is reduced, and because the backsight is close to the eye it appears very large and the slightest error of aim is obvious. Thus the fact that it is not clearly seen does not matter.

Several writers have said that the shooter does not have to think about centring the foresight in the ring of the backsight because the eye automatically looks through the centre of a small hole. They say it is harder not to do so than to do so. This may be true of some people, but not for me. I often become aware that I am looking through a peep sight off-centre. I only centre up naturally if the rifle fits me perfectly.

A second advantage of the peep sight is its orthoptic effect. The small aperture acts as an iris diaphragm which sharpens the outline of the foresight and of the target so that both can be clearly seen, although the eye is focussed on one only. The smaller the aperture used, the greater this effect. But a small aperture has the disadvantage that the amount of light let through is reduced as the square of the reduction of diameter of the hole. Consequently a hunting peep sight must have an aperture of large size if it is to be of any use in a poor light. A $\frac{1}{16}$-inch diameter aperture is most generally useful. Target peep sights are often fitted with rotating plates containing six different-sized holes that can be brought into line as desired, or with adjustable iris diaphragms as used in cameras, so that the competitor can use the smallest-size hole suitable for the amount of light on the range.

Aperture sights have a further advantage over open sights in that they do not conceal the foreground. If a peep sight is fitted to a rifle that already has an open backsight, the latter must be removed or its folding leaves kept down and any fixed standing leaf cut away so that it does not obscure the foreground.

The best foresight for use with an aperture backsight for sporting purposes is a small bead, although a blade will serve very well. For target shooting against a circular aiming mark a ring foresight is generally preferred in small-bore shooting: but a blade is used on service rifles.

Target rifles have "tunnel foresights", *i.e.* the ring foresight or blade is fixed inside a tube the purpose of which is to keep the light from shining on the foresight. Provision is made for the easy changing of the ring or blade.

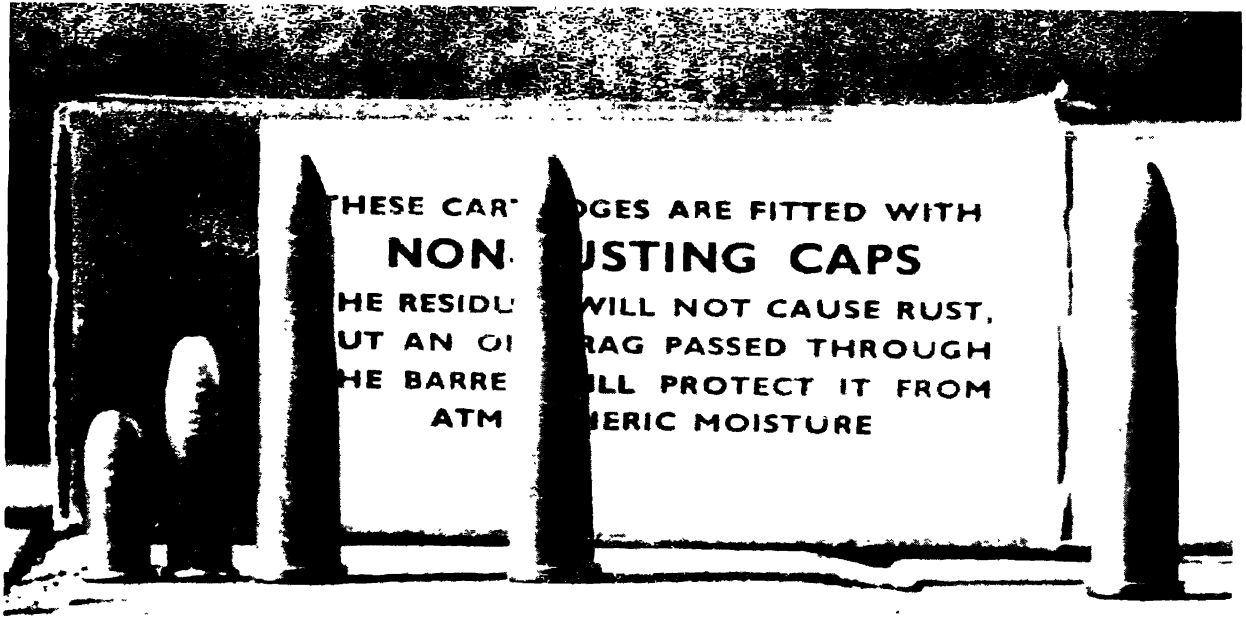


Plate X. U. S. .22 Cartridges—"Short," "Long Rifle" and "Hornet" ($1\frac{1}{2}$ times actual size).

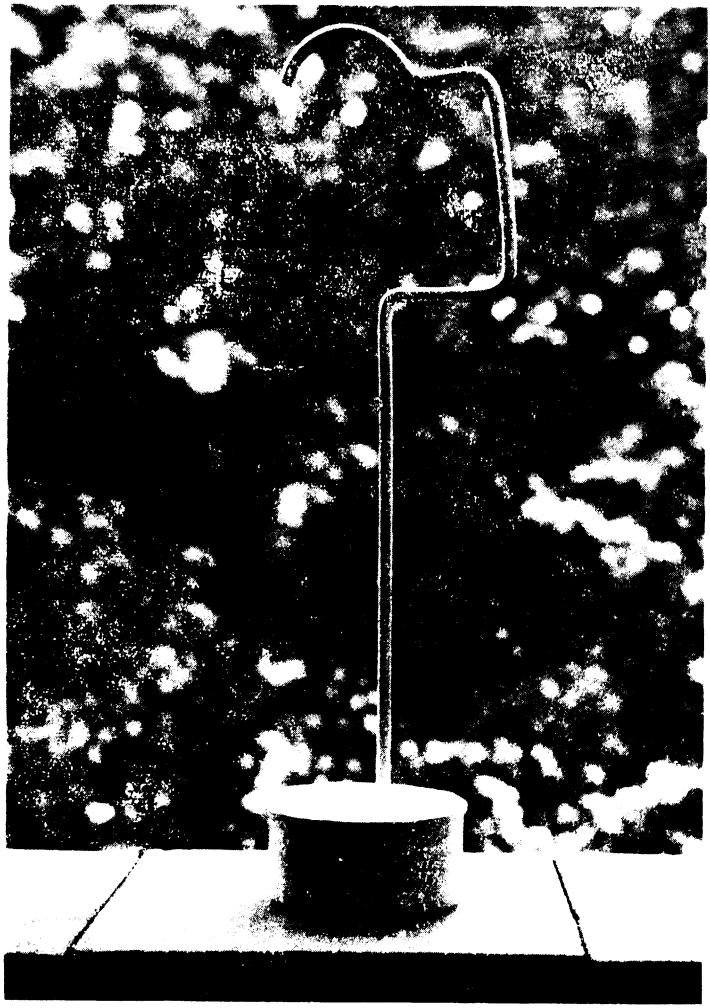


Plate XI. Home made weight for testing pistol triggers.

The success of fixing sights to the rifle barrel by a lateral dovetail depends much on the quality of workmanship. This method is not always sufficiently secure for rough usage in the field. I had one target rifle which reached me from the makers with the foresight so lightly secured that I could slide it from left to right with my fingers. This naturally made me somewhat distrustful of the arrangement.

For sporting purposes a ramp foresight made in one piece with a band going right round the muzzle and soldered securely in position is perhaps best. The blade or bead should slide into a dovetail from the front with a comfortably tight fit and be held in position by a screw or spring-loaded stud. The blade that is secured by a lateral dovetail is all right for a military rifle fitted with a sight protector but not so good for a sporting rifle normally used with the sight exposed.

There is less objection to an open *backsight* being fixed by a dovetail, because the backsight is less liable to injury than the foresight. Furthermore the dovetail can be made more substantial where the barrel is thick and there is sufficient metal to ensure secure fixing. Even so I prefer to have the sight pinned in position after it has been finally adjusted.

Aperture backsights are fixed to the action body or some other part of the action with the aid of screws. The most secure fixture I know is the Parker-Hale backsight. This fixes with a single large grub-screw to the dovetail of the Mauser rifle or to the wider dovetail of the Zbrojovka Brno. Some screw-fitted backsights are far from sturdy, in particular those used for target shooting. But in target shooting, damage to sights is comparatively rare.

An aperture backsight should be as near to the eye as practicable—or safe—and here the bolt action sets up a problem. The bridge of the action of some rifles is too far forward to be ideal, and for this reason it is usual to have the peep sight fitted on the cocking piece of the bolt, to which it is fixed by two small screws.

The Westley Richards type is probably the best of sporting-rifle foresight protectors. It is not detachable but flicks over to lie on its back along the barrel when the shooter wants to use the sight. The ordinary protective tubes that can be taken off are something of a nuisance and liable to get lost.

A practical protection for the foresight can be made by folding a piece of stout leather and stitching it to make a pocket that goes over the muzzle. The folded side of the leather goes round the underside of the barrel and the stitched side lies flat on each side of the foresight blade. It should be attached by a piece of elastic to the nearest sling eye.

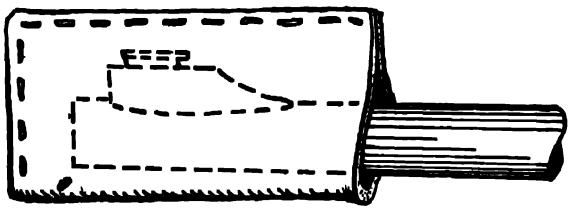


FIG. 8. Home-made Leather Foresight Protector.

Sights for cheap ·22 sporting rifles are capable only of lateral adjustment. This is done by tapping the dovetail wedge of the backsight to left or right with a hammer. In a few instances there is also a crude adjustment for elevation. The open sights of good-quality sporting rifles are permanently adjusted by the maker: and any alteration that may be found necessary in the field must be done judiciously with the aid of a fine file. In this there is a further advantage in using an aperture backsight, most of which, in particular the Parker-Hale series, are capable of easy and accurate adjustment.

The "Sportarget" sights, as fitted to the cocking piece of the Mauser or Mannlicher-Schonauer, are adjustable with vertical and horizontal clicking movements. Elevation is adjusted by a knurled ring and is indicated by a vernier. Windage, being an adjustment not likely to be altered very often, is adjusted by a screw that can be turned by a small coin.

As target sights have to be easily adjusted during shooting they are worked with knurled screws with easily felt clicking movements, one click representing one-quarter minute of angle of sight. The English Parker-Hale sights have vernier readings of elevation and windage: micrometer readings are preferred in America.

Chapter 9

Telescopic sights—Their advantages—Types suitable for specific purposes—Fitting and adjusting—Cheek pieces—Silencers

TELESCOPIC sights are the best for most purposes. There has been a good deal of prejudice against them. They have been described as unsporting, on the grounds that they do not give the animal a chance; it has been said also that they are too vulnerable for use in the field. But these objections are passing. Sportsmen now say it is better to use a telescopic sight to make sure of a clean kill than to wound an animal and let it get away to die in the bush. It is true that some sights are vulnerable to damage, and any sight badly mounted could be knocked out of adjustment, but these drawbacks are being overcome to the extent that a telescopic sight of some kind will certainly be the standard equipment of military rifles of the future. Telescopic sights for use in hot humid climates must be hermetically sealed so that no moisture can get into them and mist the lenses.

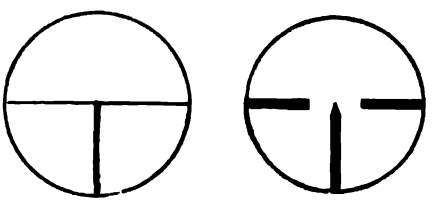


FIG. 9. Reticles for Telescopic Sights.

The advantages of telescopic sights are considerable. First, the reticle is in the same focus as the point of aim, so that the eye does not have to attempt to see both the sight and the target at the same time. The reticle stands out clearly on the target, both it and the target being sharply defined. Next, the target is magnified and definition is sharpened so that the shooter in pursuit of game can see just what he is shooting at and whether

it is worthy of a shot. Lastly, the telescopic sight is the only sight which can be used easily in the half-light or even comparative darkness. The reticle stands out plainly visible if there is sufficient light for the game to be seen, and even when the game can no longer be seen with the naked eye the increased light that is picked up brings the distant target into vision.

I recently fitted a German four-power telescopic sight to one of my Hornet rifles. After it was fitted (but not adjusted) I waited until it was dark to see how it would serve as a night glass. It was really extraordinary. The nearby fence was only just visible with the naked eye and disappeared entirely when viewed through a peep sight. But through this telescopic sight every paling was clear, and, not only that, the more distant fence which I could not see at all without optical aid came clearly into view.

Sights for heavy sporting rifles need to be brazed or otherwise immovably secured to the rifle. The mounts may be fixed either to the barrel or the action, but on no account to both. Mounts for light rifles such as ·22 rimfire are satisfactory if screwed to the rifle, although I prefer to have them both screwed and soldered, and like still better the dovetail to be part of the action body itself.

The usual way of mounting a telescopic sight is by a pair of dovetails securely fixed to the rifle. The tube of the telescope has mounts which slide over the dovetails and are held firmly in position by knurled screws. V-cuts in the sides of the dovetails are so arranged that every time the sights are put in position they fall exactly into place before the screws are tightened up. With this arrangement sights can be taken off and replaced as required, with usually negligible effect on adjustment.

Telescopic sights for heavy rifles have mounts which engage with dovetails soldered or brazed on to the tube. In cases of only moderate recoil, however, the telescope can be carried in mounts that clamp round the tube. Messrs. Parker-Hale make several patterns of this kind.

Sights for target rifles are supported in a different way. The mounts are secured to the dovetail with knurled screws in the usual manner, but each mount carries a ring through which the telescope tube passes, the tube being kept in place by three supports projecting inwards from each ring. In the foremost

ring are two fixed points and one which is spring-loaded. The spring-loaded point presses the tube against the other two, thereby keeping it in position. In the rearmost ring is one spring-loaded point and two which give micrometer screw adjustments for elevation and lateral adjustment. On the recoil of the rifle the tube slides forward, having to be pulled back before the next shot is fired. This arrangement of adjustment is very satisfactory for target purposes, but for obvious reasons not well suited for use in the field.

The best adjustments for sporting types are internal, *i.e.* two screws marked with gradations are fitted on the tube to control vertical and lateral adjustments respectively. These are provided with locking screws to secure them when final adjustments have been made. They should also be fitted with caps to exclude dirt and damp and discourage interference by anyone into whose hands the rifle may fall.

The position in which a sight is mounted, both as to height and distance from the eye, is of importance. One of the main faults with early telescopic sights was that they were mounted high so that the ordinary sights could be used while the telescope was in position. This meant that when the telescopic sight was used the eye had to be higher than usual, and the butt did not rest against the cheek of the shooter as it should do. Steadiness of hold suffered accordingly.

Telescopic sights are now mounted as low as possible, and not infrequently the bolt handle of a bolt-action rifle has to be modified to accommodate them.

A heavy rifle recoils two or three inches when fired. For this reason the telescopic sight must be well away from the eye to avoid injury to the shooter. In determining the position, it has to be borne in mind that when the rifle is used in the prone position or when shooting upwards the eye is nearer to the sight than when an off-hand shot is taken on the level. To permit the eye to be a safe distance from the sight, the sight has to be optically designed so as to give long "eye relief", *i.e.* the full field of view is at its best when the eye is several inches from the eye-piece. As the eye is approached further towards the sight, or is drawn away, the picture shrinks, occupying part only of the lens.

In the design of telescopic sights there is a number of factors which are not altogether compatible, and therefore a satisfactory

compromise has to be reached. High magnification makes focus critical, yet for use in the field focus must be constant at all different ranges. A sight with high magnification and clear definition can only have a wide field of view if the object glass is very large. High magnification reduces illumination.

Taking these and some other factors into account, it is more or less generally agreed that a magnification in the region of two and a half diameters is sufficient for big-game shooting, but the field of view should be at least thirty feet at one hundred yards range. Focus should not be critical and illumination should be good. For shooting small game at long range a higher magnification is desirable, but the field of view can be reduced since long shots at small game and vermin are often taken at a sitting target. A magnification of four diameters is satisfactory for this purpose. For target shooting it is usual to have a magnification of twenty diameters so that the sight can be used as spotting telescope also. Such a sight must be readily focusable. Width of field is of little importance, but definition must be good. If the sight is to be used on a small-bore rifle, an eye relief of as little as two inches is sufficient.

FIG. 10. Hensoldt × 2¾ Telescopic Sight.
(*By courtesy of Thos. Bland & Sons Ltd.*)

Too high a magnification makes for dither in the sight. A target rifleman in the prone position and using the sling will experience sight dither if he is using a twenty-power telescope, which would not be apparent if he were using metallic sights. But, provided that the reticle moves about in the centre of the ten-ring, he is content. A sportsman shooting off-hand, of course, could not afford a magnification that would make his sights swing so disconcertingly.

When buying a telescopic sight, test it for parallax. If the rifle is fixed motionless and the sight is focussed on an object at the maximum range at which the rifle is intended to be used, the reticle should not move relative to the point of aim if the eye is moved up and down, or from side to side. If it does move, giving a different point of aim with the movement of the eye,

parallax is present, and, unless the sight is fitted with a parallax adjustment, this can be cured only by the maker of the sight. Some parallax is, however, to be expected at very short ranges at which the sight is not likely to be used or, if it is, at which slight error of aim will not matter.

Because of the difficulty of the work and the risk of doing serious damage to the rifle should anything go wrong, most shooting men get their telescopic sights fitted by a competent gunsmith. It is important, however, that they should make sure that the sight is fitted in the position that suits them individually, not just where the gunsmith finds it convenient to put it.

Gunmakers fitting telescopic sights usually sight them in, thereby adding to the cost of the operation. In the case of sights without any internal adjustments this sighting is permanent, and elevation, at least, is adjusted once and for all. The shooter may therefore accept the rifle as being sighted with sufficient accuracy for sporting purposes.

But many keen riflemen, particularly those with a sound grounding on the target range, do not take anything for granted. They want to know that the sights are right *for them* and, therefore, want to adjust the sights themselves on the range. It follows that this class of riflemen must have sights with adjustments either entirely internal or with internal adjustment for elevation and external adjustment for lateral correction.

In the case of one of my telescopic sights the work of fitting presented no difficulty at all and was the easiest I had ever experienced. This was because the rifle already had dovetails formed on the top of the action body, and Parker-Hale mounts were available to fit them. The only snag was that owing to the large size of the eyepiece I had to grind down the bolt-lever—a mighty hard piece of heat-treated steel—and then, of course, repolish and reblue the metal. This done, all that remained was the adjustment.

When dealing with rimfire rifles the cost of ammunition matters little, and you just go ahead and shoot groups, making the necessary adjustments until the groups are centring in the ten-ring of a target card. But if (as I was in this case) you are sighting a sporting rifle that takes expensive cartridges, it is worth-while planning the procedure to cut down cost to a minimum. In such cases the first thing to do is to place the rifle in

a rifle vice or on a telescope tripod, then sight it on some easily distinguished object by looking through the bore. The lateral adjustment must be made to bring the reticle on a vertical line passing through the object. Lastly, before taking the rifle out of the vice, the vertical elevation must be adjusted so that the reticle is aimed a little below the object seen through the bore.

While making this adjustment, the direction in which the adjusting screws have to be turned to move the reticle to left or right, and up or down, should be observed and written down. This practice will save a lot of language and ammunition. It is very easy to get confused as to which way to turn the screws of telescopic sight adjustments, and this for a number of reasons. First, there is no standard in design, and a right-hand turn on the windage screw may move the reticle to the left on one sight and to the right on another. Second, the marksman who is used to peep sights moves his backsight in the direction he wants the shot to go, whereas when adjusting a telescopic sight he has to move the reticle in the opposite direction, *i.e.* towards the shot. Third, the external adjustment provided in a Parker-Hale adjustable mount has to be moved in the reverse direction of the internal adjustment: it moves the rear end of the telescope in the direction it is desired the shot shall be moved.

The Parker-Hale adjustable mount is simple to use. The mount with the adjustment should be placed at the rear. It can be put in the front if there is any special reason for it, but in that case, of course, the adjustments are the reverse of those described. There are two screws, one on each side of the mount, each of which screw in and push ahead of them the dovetail that holds the upper part of the mount. Thus, to move the mount to the left you have to slacken off the left-hand screw and tighten up the right-hand screw.

When the rifle is taken on to the range it should first be fired at short range or at a target with a very large sheet of paper behind it, as it is possible that the first shot may entirely miss the ordinary target. Then, when the first rough adjustments have been made to ensure that the shots will be on the target, shooting can be started at the range for which the sights are to be adjusted. By careful shooting with the sling the group can gradually be brought on to the centre of the aiming mark. Finally, when the group centre coincides with the centre of the bull, the locking

screws must be tightened. Then, without any further adjustments being made, a group should be fired to check the accuracy of the sighting and to give the rifleman confidence that the rifle is correctly on aim.

The foregoing description is of the comparatively easy adjustment of telescopic sights having internal adjustments for windage and elevation, or internal elevation and external windage in the mount. If there is no screw adjustment for elevation or windage, the sight has to be adjusted by filing and finally stoning the mounts little by little, until the reticle is on aim. This is tricky work, best left to a gunmaker, unless the amateur is himself a competent workman.

Because a telescopic sight is unavoidably set higher than the original iron sights of a rifle, the head has to be held higher relative to the butt. This may mean that the cheek no longer rests comfortably and the hold becomes unsteady. The remedy is to fit a cheek piece. If the rifle is a first-class weapon and the shooter can afford the expense of having it made to his requirements, an entirely new stock with cheek piece can be carved, or a cheek piece made and fitted to the existing stock by a professional gunsmith. But this is expensive work not justified in the case of an ordinary mass-produced sporting or target rifle. The alternatives are to carve a cheek piece out of walnut, or to form one out of plastic wood.

I am not much of a workman, but the way I made two cheek pieces may interest those who are, and who can probably improve on my methods.

The first cheek piece I made I cut to shape out of hardwood, with a flat surface sloping at the correct angle and a curved outline. Next I hollowed the underside with a chisel except for a border about $\frac{3}{8}$ inch wide, scraping the rough chips out of the hollow but leaving it rough. Then I scraped down the edges only, first with a rasp and then with a file and fine sandpaper until the cheek piece bedded down perfectly on the curved surface of the butt.

At this stage I marked its outline with a pencil and within the area so enclosed took the polish off the butt of the rifle with fine sandpaper. On the roughened surface I applied celluloid solution and allowed it to nearly dry. I also applied celluloid solution to the underside of the cheek piece and allowed it to

dry by the same amount. Then I filled the cavity of the cheek piece with a suitable colour of plastic wood, and pressed the cheek piece on the butt of the rifle until the excess plastic wood was all squeezed out. I clamped the cheek piece in position and wiped off the excess plastic wood and celluloid solution with a rag soaked in amyl acetate, aided where necessary by fine sandpaper.

The work was left for a week untouched, as plastic wood if covered can take a long time to dry. I had made the recess as shallow as possible, for too great a depth of plastic wood is liable to shrink and crack. However, no trouble developed, and now the cheek piece seems to be well and truly stuck on. The last process was a general cleaning-up. The clamp was removed, the finest sandpaper applied where necessary and the work, new and old, repolished by the time-honoured process of smoothing with powdered pumice and rubbing day after day with a little linseed oil and the palm of the hand.

Men who are concerned merely with practical results, and who do not insist on having their cheek pieces carved out of solid walnut and fitted to the stock so that you cannot see the join, often patch up with plastic wood. This is sometimes done with light-coloured plastic wood shaped as necessary but in no way finished or even coloured to match the existing work. There is, however, another way of making plastic-wood cheek pieces which are both practical and of reasonable appearance, although not comparable with the woodcarver's art. The method is as follows.

Take two colours of plastic wood, *e.g.* mahogany and walnut, roll them out on sheets of cellophane, then place the two together and peel away the cellophane. Roll up the plastic wood like a swiss roll, cut it down the centre and put the two pieces back to back and press them well together to form a sausage.

Place this sausage in a sheet of cellophane, fold it over and bring cellophane and plastic wood to rest on the butt of the stock with the fold of the cellophane just above the comb. Then press the plastic wood, squeeze and smooth it to shape exactly as you want it without messing your fingers or the butt of the rifle. Bring your cheek into position and make any modifications necessary: and by pressure and stroking with the fingers trim the edges so that the cheek piece takes an attractive form.

When you have it worked up to your liking leave it resting on the stock of the rifle, but peel off the upper layer of cellophane to allow one surface to dry. Only when the plastic wood has dried sufficiently for it not to droop out of shape should it be lifted off the butt and the remainder of the cellophane removed. Then the cheek piece can be left for several days to dry out thoroughly and become hard enough to be worked over with tools and sandpaper. During this drying it may warp a little but this should not matter.

Once the cheek piece is hard and dry, fettle the edges and work over the whole surface with a fine file and sandpaper until it is fit to take a polish. Clean the butt of the rifle in the position where the cheek piece is to be fitted and coat both the cheek piece and the butt with celluloid solution, allowing it to become partly dry. Place some plastic wood between the cheek piece and the butt, and press until it comes out at all edges. Remove the surplus, bind on the cheek piece with an ordinary bandage and leave it for several days for the new plastic wood to set.

The work that now remains is merely finishing. Plane the surfaces with a small hand plane. With a fine file and sandpaper trim round the join between the plastic wood and the butt, working over any imperfections until they have disappeared. Finally, smooth with powdered pumice and polish in the usual way with linseed oil.

A ·22 rifle fitted with a silencer and used with low-velocity ammunition makes hardly any noise and is therefore very convenient for dealing with vermin without disturbing game. Parker-Hale's silencer, the "Sound Moderator", is not expensive, but an endorsement on the Firearm Certificate is necessary before it may be purchased. The rifle has to be sent away for the silencer to be fitted, as a screw thread has to be cut on the end of the barrel. Before deciding to have your rifle adapted you should bear in mind that the fitting of a silencer alters the zero of your rifle, and if the sights are set for when the silencer is in position, they will be wrong when it is taken off.

Silencers have limitations. A marked reduction of noise is possible only if the muzzle velocity of the bullet is less than that of sound. For when the muzzle velocity exceeds the speed of sound the bullet makes a sharp crack in hurtling through the air, and nothing can be done to reduce it.

To be effective a silencer needs to be large enough to accommodate at moderate pressure the gases produced by the explosion. On other than small calibre rifles and pistols this necessitates an inconveniently large and heavy cylinder which, in the case of a pistol, makes the weapon unhandy and awkward. On this matter, Roger Marsh, a well-known American authority, wrote to me:

"It is of course impossible to silence a bullet at supersonic velocity, but that does not mean that the silencer of a high-velocity rifle is totally useless. It makes impossible the attempt to locate the rifle from sound or smoke or flash. The bullet 'whip' continues but only makes things worse. As for the effectiveness of a silencer incorporated into the original design and construction of an autopistol, examine the record of British 'silent' ·32 autos during World War II. They are practically inaudible—impressive and not a little frightening. Some silencers include rubber plates which replace the Maxim's baffles: the projectile passes through them, and they must be replaced at intervals. Another type—large and rather clumsy—is little more than a large expansion chamber without baffles or anything else except a sound-dulling layer or coating inside the walls."

As Mr. Marsh remarks, several types of silencer have been made, but the broad principle is the same. Undue complication of design or in use of materials is unnecessary. To reduce the noise of muzzle blast the gases must be permitted to expand in a chamber until the pressure has dropped considerably, and then allowed to escape at reduced pressure through a small hole. If the gas has to pass through several holes in series, the rate of escape is reduced, and, with it, the amount of sound. The Parker-Hale Sound Moderator is typical in this respect. It is a metal tube which screws on to the end of a rifle barrel. The end nearest to the muzzle contains the expansion chamber, and in the other end is a series of baffle plates each punctured by a round hole sufficiently large to let the bullet pass freely, and through which the gases escape after the bullet has gone. The Moderator is made so that it can be taken to pieces in order that powder residue may be removed from time to time.

Chapter 10

A new thrill with an old flame—Buying antiques—Renovation—The law relating to using muzzle-loading rifles—Re-proving—Muzzle Loaders' Association of Great Britain —A memory of the past

"My favourite sport is wildfowling; my second is using muzzle-loading weapons," said one of the muzzle-loading enthusiasts in a long discussion I had with him. "To use a muzzle-loader on wildfowl is my idea of sport *par excellence*. But it is essentially a fair-weather sport, and opportunities to enjoy it to the full don't often occur in these islands. My one big ambition is to use one of my muzzle-loading rifles on an African buffalo, but it is one ambition I may never be able to realize. I have shot buffalo with a ·375 and a ·500/450, but what a thrill it would be to get a buffalo with a muzzle-loader!"

Once you have rammed a charge down the barrel of a muzzle-loader, primed it and fired a bullet into the bull—once you have smelt black powder and got the grime of the smoke on your hands—there is a danger that its fascination will get you. You start taking an interest in the rusty old guns in the windows of junk shops. Then when you see a really fine piece in its polished wooden box, together with powder flask, bullet bag, mould, and ramrod, you fall into your first really serious temptation. And before you know where you are, the weapon is yours and you are taking out the breech plug to examine the condition of the barrel and see whether you've got a bargain suitable for use on the range—or merely another item for the collection.

Buying antique arms for actual use in sport or on the range is not the same thing as collecting for fun or as an investment, although in both instances the purchaser needs to be wary. To be of value, an antique has to be both old and in fair condition. So a weapon of ancient pattern that is in good condition but not pricey is almost too good to be true. The forgery of antique weapons is difficult: but it can be profitable, and many forgeries have been made. Moreover, they are not always easy to detect.

The man who is buying old weapons for use rather than as collectors' pieces is not necessarily out to obtain the most valuable specimens. His interest will lie in weapons of more recent manufacture—percussion guns and rifles rather than flint locks—and they should not be expensive even when of high quality since percussion guns are not strictly antiques.

The most attractive-looking weapons are those with barrels of Damascus twist. And these may prove good investments in the long run, for the time will come when any guns with Damascus barrels will be sought after by collectors. It is not so very many decades since Damascus was the best material for gun barrels, highly prized for its appearance and overvalued for its strength. It ceased to be manufactured some time after the introduction of high-quality steel for barrel-making. There are many kinds of Damascus and other twists, each with its distinctive appearance.

When a gun has been purchased it has to be renovated. This is a specialist job. A valuable piece deserves to be sent to a firm of gunmakers experienced in renovation; it should not be touched by an amateur unless he is really competent.

If you think you can do the job yourself, don't just start off with the emery, for this is the way to ruin a good weapon. There are circumstances where emery can be used, but not many. It should not be applied to engraved work or Damascus—only to smooth surfaces which can be polished and blued. Incidentally, practically all old rifles and guns were either blued or russeted, and if renovated they should be finished in the same way. Only pistols of all-metal type were commonly sold "in the white" and not all of these: a heat-treated finish was not uncommon at one time.

A method of cleaning engraved work recommended in an old book was to soak for two or three weeks in benzine, then laboriously to rub off the rust with nothing more severe than woollen rags. Another collector's book recommends the de-rusting of locks by soaking for a long time in paraffin and finally drying off and cleaning. I have also seen the recommendation that locks should be placed in oil raised to the temperature at which it smokes. I'm not too happy about this, particularly if it is intended to put the weapon back into service, for this is the temperature used for tempering springs, and if applied too long might possibly have an adverse effect on the springs. Judicious

application of heat is one of the ways of getting out a breech plug that is rusted in.

The solution that was used for browning the old Martini-Henry rifles consisted of:

Spirits of wine	5 oz.
Spirits of nitre	8 oz.
Tincture of steel	8 oz.
Nitric acid	5 oz.
Corrosive sublimate	4 oz.
Blue vitriol	4 oz.
Water	1 gal.

This was a typical solution of the kind applied to metal heated to the temperature of boiling water and kept at that temperature while the solution acted. Gunmakers throughout the world had similar solutions and, it was said, secret formulas that they found most effective.

Ready-made solutions can now be purchased, and these include not only the kind intended for application to heated metal but also cold-blueing solutions.

Probably the best known of the former is Parker-Hale's Old English gun-blueing solution, applied to hot metal that has first been boiled in caustic soda solution (2 oz. of caustic soda to the half gallon) to remove grease and then heated in clean boiling water. The solution should also be heated, using a wide-mouthed bottle, the bottom of which is lowered into the boiling water. When the work to be blued has become thoroughly hot, it is taken out without being touched by hand or by anything greasy: the surplus water is knocked off and the hot solution applied with a cotton swab as quickly as possible with long, even strokes until the whole surface has been covered. The work is then immediately returned to the hot water to kill the action of the solution and reheat the metal. This process is repeated about eight times, loose rust being wiped off between each repetition. When the desired colour has been attained the work is boiled for three minutes, the water shaken off and boiled linseed oil applied with a woollen cloth.

Cold blueing (also supplied by Parker-Hale) is very useful for colouring small parts such as screws or components that have been home-made or altered. The work can be cleaned with

alcohol or carbon tetrachloride to remove all grease, and then the solution applied with a cotton swab and allowed to act for three minutes. The surface is then flushed with water and the work allowed to dry, after which it is rubbed down lightly with fine steel wool and polished with soft cloth. The process is repeated as many times as required before receiving the final oil coat.

Probably the manufacturers would say that I do wrong, but I use cold-blueing solution on heated work and get much quicker results, which have so far proved satisfactory and permanent. The method I use is to de-grease with methylated spirit, then hold the work under a stream of boiling water until thoroughly hot. I shake off the surplus water and apply the cold-blueing solutions to the heated surface in the same manner as for hot solutions, except that I do not heat the solution before application. Finally, I wash the work in boiling water, shake off the surplus until dry and apply linseed oil.

To anyone who intends to do any blueing I recommend experimenting with the available solutions to get the knack of applying the solution evenly, to keep the work hot, and to avoid spoiling the result by allowing grease or finger-marks to get on it.

Dents can be removed from old woodwork by steaming or by placing wet blotting paper on the surface and applying a hot iron, provided that there is no ornamental inlay. This takes off the polish, which has to be renewed by applying raw linseed oil. This is done by rubbing with the palm of the hand until the oil disappears, and repeating the process day after day until the desired degree of polish is attained. Some people recommend walnut oil for this work.

A man who is good with his hands can restore checkering that has become worn and damaged. This work requires practice and skill, but the tools can be obtained from Parker-Hale, and you can practise on scrap pieces of hardwood until you feel competent to get to work on a gunstock. However, it should be borne in mind that early weapons, even those by famous makers, did not always have the fine-quality checkering that is now usual on best guns and rifles. For this reason a good piece intended for a collection should have the checkering left severely alone, for fear of making it look counterfeit.

Only one tool is absolutely necessary for restoring old checkering. This is the cutting-out tool, which is a flat steel blade with

a row of teeth at one end. It is held in the hand with the thumb on top and the forefinger running along the side, and is rubbed gently backwards and forwards in the groove, which should be deepened slightly from end to end. The process should be repeated, first in one set of parallel grooves, then in the diagonal set, then back to the first set, and so on alternately until the diamonds between the grooves are all brought up to sharp points. When the cutting is finished, the work should be rubbed with raw linseed oil and left for the oil to soak in. Later, all surplus oil should be removed with a brush, as any left in the grooves makes the work look gummy.

In Britain anyone may buy an antique at any time and anywhere without concern for firearms restrictions, for Section 33 of the Firearms Act, 1917, excludes from the Act any "antique firearm which is sold, transferred, purchased, acquired or possessed as a curiosity or ornament". But as soon as anyone starts to *use* an antique rifled arm it needs to be included on a Firearm Certificate.

Before using an old muzzle-loader it is advisable to have it re-proved. An old-time method of proving was to load with a double charge of powder and two bullets. Some enthusiasts I know of did it for themselves by tying their gun to a tree, a string to the trigger, and then retiring to a safe distance. But police authorities usually ask for muzzle-loading rifles to be officially proved at either the London or Birmingham Proof House before they will issue a certificate.

Anyone who knows the drill and has the necessary skill can prepare a gun for proof according to the rules of the Proof Houses. But the shooter who is not an amateur gunsmith is advised to get a gunmaker to strip and prepare the gun for proving. In this case all he has to do is to declare the load of powder and shot that will be used, and foot the bill.

The Muzzle Loaders' Association of Great Britain holds rifle-shooting events at Bisley and clay-bird competitions in the counties: for its members are interested in both the muzzle-loading rifle and the fowling-piece. The muzzle-loading rifle is used in Great Britain on both large and small game. The advantages of muzzle-loading guns, not only of moderate gauge but also large pieces for wildfowling, can be appreciated by all who complain of the present high price of shotgun cartridges.

And the greater number of punt guns still in use, particularly by the professionals, are muzzle-loaders.

The muzzle-loading rifleman carries a flask of powder, a pouch of bullets and a box of caps. The cap box sometimes consists of a mechanism containing a spring so that the caps are dispensed one by one. The powder flask has a measure screwed to its outlet so that the powder flows from the flask to the measure when a lever is depressed. The measure then contains a known quantity of powder. This can be tipped direct down the barrel of the gun. Old-time riflemen, however, often preferred to empty the contents of the measure into the bowl of a clay pipe and then pour from the pipe into the barrel. This was to prevent the powder flask being blown up should the powder be ignited by a smouldering wad or patch left in the barrel from the previous shot.

The next action is to wrap a bullet in a patch of greasy linen, place it in the muzzle, push it down with the ramrod and tap it firmly on to the top of the powder. Then a cap is placed on the nipple and the rifle is ready for firing as soon as it is cocked.

One of the obvious dangers of using muzzle-loading guns and rifles is the possibility of loading twice in error, so that the charge is excessive or has to push out a double weight of bullet. There is also a greater danger of leaving a muzzle-loading weapon loaded than there is with any breech-loading weapon, because once the bullet is down it has to stay there until it is fired. A precaution to avoid such accidents is to mark the ramrod so that it can be used in the barrel as a dipstick. Some shooters make a practice of leaving the ramrod in the barrel when the rifle is empty and keeping the hammer down. Theoretically the rifle is then always loaded if the ramrod is out and the hammer at half-cock.

As a small boy I read with great delight how Sir Samuel W. Baker, the celebrated sportsman, used his double-barrelled 10-bore muzzle-loading rifles with two-grooved bullets and six drachms of the best fine-grain powder. For patches he preferred silk soaked in a mixture of one part of beeswax and two of fresh hog's lard free from salt. The wax was added because it did not become runny in the heat. And he liked his bullets to be of lead without any hardening mixture that would reduce their weight and power of penetration. For heavy-game shooting

there could not, he said, be a fairer standard for the charge of powder than one-fifth of the weight of ball for all bores. This, incidentally, compares closely with I.C.I. recommendations for the black-powder charges of shotgun cartridges except at extreme gauges. (See Table 4.)

TABLE 4

Gauge	Black Powder (drams)	Shot (oz.)
4	9	3¼
8	8	2¾
8	7½	2½
8	7	2⅜
8	6½	2¼
8	6	2⅛
10	4½	1¾
10	4	1⅝
10	4	1½
10	3½	1⅜
12	4	1 9/16
12	3¾	1½
12	3¼	1¼
12	3	1⅛
14	2¾	1
16	3	1⅛
16	3	1 1/16
16	2¾	⅞
20	3	1
20	2¾	15/16
20	2¼	¼
24	2	⅝
28	1¾	9/16
32	1⅜	½
·410	1	⅜
·410	¼	5/16
·360	½	3/16

I am told by G. Hoyes, founder of the Association, that somewhat lower powder loads than those given in the I.C.I. table are preferred by many present-day users of antique shotguns.

"For muzzle-loading shotguns the secret of loading is not to use too much powder. Ranges will be less than with the same loads per bore with a modern gun, so it is necessary to conserve pattern. The shortened ranges make a slight reduction in muzzle velocity acceptable.

In a muzzle-loading 4-bore I would use not more than 7½

drams of coarse powder with 3¼ oz. shot. And, of course, the shot would be not less than No. 4 and more likely No. 1.

In my 'match' 10-bore, weighing 6¾ lb., I find 2¾ drams powder (Curtis's and Harvey's No. 4) and 1 oz. of shot gives the best results. But if the bore were 12 I would use only 2½ drams.

My double-barrelled muzzle-loading 16-bore performs best with 2 drams of fine-grain powder and ¾ or ⅞ oz. shot. My very heavy 10-bore, 14 lb. 10 oz. of it, handles any load of shot from 1 to 2 oz. but it likes only 2¾ drams powder, coarse for preference, per ounce of shot.

At all times I use the best wadding I can get—either cut from felt sheet or bought. The thickness of the wad should not be less than half diameter of the bore. I also use a stout card wad under the shot.

As a general rule, if 1 oz. of shot is allowed for each 6 lb. of gun, and 2½–2¾ drams powder is allowed for each ounce of shot, that will be a sound basis to start with. But some variations, perhaps only slight, will generally be necessary to get the best out of individual guns.

Too much importance cannot be given to the wadding used in muzzle-loading guns. But whatever wadding is used, it must be rammed down well.

One other little point on which I personally insist is that nipples must be capable of being taken out in the field. If a charge misfires, or if (as has never yet happened) I forgot the powder in rifle or gun, I take out the nipple, and put down the hole as much powder as I can get in. Put back the nipple and try again. It has never yet failed to set off the main charge."

Chapter II

The shooting positions—Requirements of marksmanship—Moving targets—Balance and fit of rifle—Constructing a range

In these days of artificial pleasures when instincts can seldom find their fulfilment we have become accustomed to accepting a conventional alternative for the thing itself. The man who fences with the foil is bound by rules that tend to make his sword-play, however skilful, very different from the real thing. In like manner, practice with rifled arms (but not with the shotgun) has become in Britain largely a matter of shooting in the prone position at motionless targets, at a limited number of fixed ranges and with the aid of all permitted accessories that go towards the achievement of high scores in competition.

It is therefore not out of place to remind the British shooter that the purpose of the rifle or pistol is primarily the hitting of live targets in the fields of sport or battle, and mostly in circumstances that do not permit shooting with the greatest accuracy, the use of special equipment, the firing of sighting shots or the adjustment of sights. In America the competitor is expected to become proficient not only in shooting prone but also in the standing and kneeling positions. I think it would be beneficial to the sport if a similar requirement were set in Britain. I would also encourage greater interest in shooting at moving targets. Laterally, moving targets are ruled out of pistol competitions on the ground of the dangers involved. But even so, facilities for shooting at disappearing or advancing targets at some of the more prosperous clubs could be organized and would add much to the interest of the game. It would also make pistol shooting of more real value in times of emergency.

I do not suggest that tuition in rifle or pistol shooting should not begin with and be supported by regular practice at fixed targets, because the tyro most quickly gains confidence in his weapon and himself when he can consistently make small groups on a target. But this is only the beginning from which

to advance further. All the American experts at target shooting and field sport agree on this

Rifle barrels are scientifically tested by being placed in mechanical rests which ensure that the barrel is retained in the same position for each shot and that there are no changes in the points of contact. Such tests reveal the performance of the interior of the barrel and of the ammunition used. Amateurs and armourers when adjusting rifle sights or testing for accuracy use a bench rest. This is a wooden rest having a notch lined with soft material to support the barrel. It is fixed to a bench on which the shooter supports his elbow. He holds the rifle against his shoulder, using his right hand only. His left hand lies idle. Although bench-rest shooting sounds easy, it has to be learnt before consistent accuracy can be achieved. I always use the prone position when adjusting sights, partly to avoid the trouble of fixing up a bench rest, but mainly because the bench rest does not give the same group centre as when the rifle is held in the hands.

Of the practical shooting positions that can be used in the field, the prone position is almost the best for practical purposes if you want to shoot accurately. The back position is steadier and is much used in match rifle competitions, but is of very limited use in the field. And it is not all that much steadier.

The other positions, standing, kneeling and sitting, are much less steady, but as the majority of shots against game are taken either standing or sitting, these positions are of great importance to the practical rifleman.

In the prone position the shooter lies with his body at 45 degrees to the target, his feet wide apart and his heels well down. The left hand supports the fore-end of the rifle well forward, and the left elbow is kept well under the rifle, not out to the left. This position is not comfortable until it has been practised. The right hand grips the hand of the rifle and the right elbow is out to the right. The body is as low to the ground as possible. With practice the shooter will learn to carry the left hand farther forward and will finally discover the position from which he shoots best and with the most comfort.

Steadiness is greatly increased by the use of a shooting sling, an essential item of equipment to the competition shooter.

The English sling has one end attached to the front of the fore-end and the other to the rear. The sling passes under the back of the left hand, over the wrist from right to left and round the back of the upper arm from left to right. It is tucked as far towards the armpit as it will go and stay put. The American sling is attached to the front of the fore-end only and forms a loop round the arm. Similar to the American sling in this respect is the cuff sling, which consists of a cuff strapped round the upper arm and attached by a hook to a strap which connects to the front of the fore-end.

The sling is tightened until it takes the weight of the rifle, so that the rifle remains in position even if the right hand is taken away, resting on the left palm and held against the right shoulder by the tension of the sling.

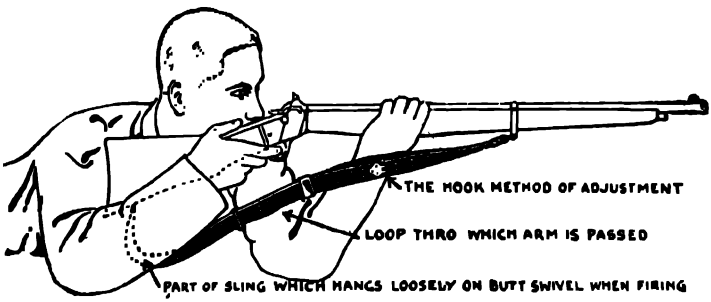


Fig. 11. Using the American Sling.
(*By courtesy of Parker-Hale Ltd.*)

Hand-stops are now usual in small-bore shooting. They are fixed to the underside of the fore-end to prevent the hand from slipping forward when the sling is being used. Special adjustable hand-stops are available, but I have known shooters to use ordinary rubber door-stops screwed on to the fore-ends with satisfactory results. A thick soft glove on the left hand is a help when shooting with the sling and hand-stop.

The difficulty of target shooting in the off-hand position is getting the shot off when the sights are in line. The swaying sights cannot be held on the mark, so the shooter has to put some pressure on the trigger as the sights move in towards the mark, hold it constant as they sway out, and increase the pressure again as they return on line, until finally the shot is released.

In the standing position the target man usually gets the best results if he adopts the hip-rest position. He rests his elbow on his hip, supporting the rifle. If the competition permits, he will use a palm-rest, which projects below the fore-end. This is a comfortable and comparatively steady position for shooting at fixed targets, but of no use against moving game.

In sporting shooting, conditions are very different from target shooting, as shots often have to be taken in haste or at moving game. The target man's methods apply only when his quarry can be shot by taking careful aim from a steady position.

The sportsman's off-hand position is very like that adopted for shotguns. The left hand is carried well forward to grip the foremost part of the fore-end; the right elbow is raised sufficiently to bring the butt in the correct position. If it is possible to obtain increased steadiness by resting the left wrist against a convenient tree, so much the better. But the rifle should never be allowed to touch the tree, as any such contact would influence barrel flip and result in a wild shot.

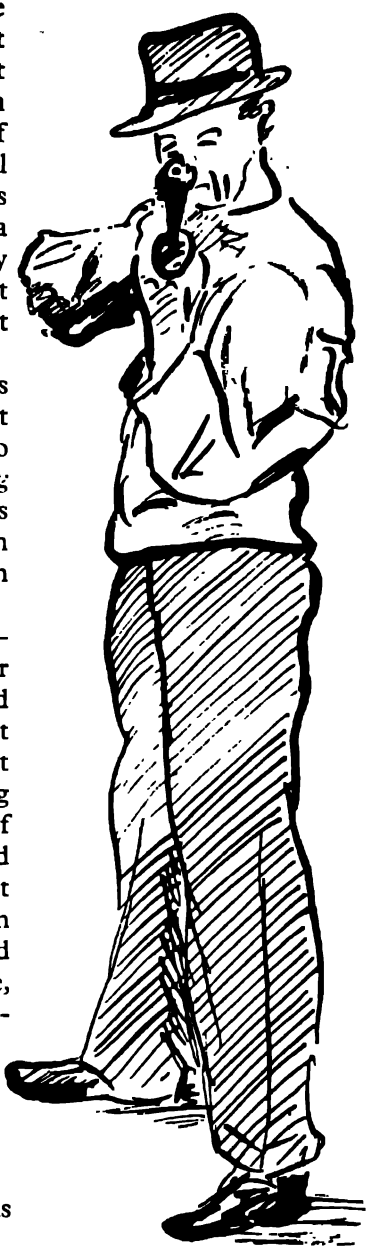


FIG. 12. Off-hand Position as viewed from Front.

The sitting position varies with the individual. Some men cross their feet: some place them apart and dig their heels in. The only thing that is not allowed in competition is bringing the crossed feet back behind the knees. The elbows rest on the inside of the legs near the knees and, thus supported, afford considerable steadiness.

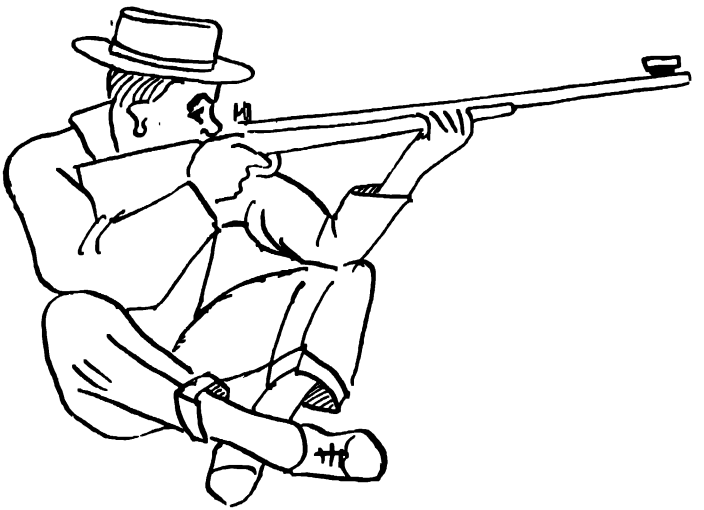


FIG. 13. Sitting Position with Ankles crossed.

In the kneeling position the left knee is bent with the foot flat on the ground. The right knee rests on the ground, and the shooter either sits on his heel with the toe digging into the ground or on the side of the foot. Both positions of the right foot are uncomfortable and tiring until much practised. The discomfort of the position with the right toe towards the ground is much reduced when one is wearing an army boot with a stiff sole that does not bend under the weight of the body. This position is not particularly steady, and its only real practical use is when the sitting position, which is lower, cannot be adopted because high-growing weeds get in the line of sight.

The back position is said to have developed as a military position for shooting downhill. It is not altogether comfortable but is extremely steady. Virtually all match-rifle competitors use it. As the name of the position indicates, the shooter is on

his back. His left knee is raised and bent, his right knee bent out towards the right, the lower part of the right leg hooking round the left foot. The hand of the rifle is held with the right hand: the barrel rests on the right leg: the left hand is passed behind the head to help to support it when using the sights. Because of the long distance the eye is from the normal sights, match rifles are fitted with optical sights, the backsight being mounted high at the rear end of the butt close to the eye of the shooter.

In all marksmanship there are three main requirements: holding, aiming and trigger squeezing. The holding must be steady; and although some authorities have achieved steadiness in different ways, the general opinion is that the hold must be relaxed and comfortable—not tense. The beginner may find this difficult when he is struggling to keep his left elbow underneath the rifle and feels himself to be trussed up with the sling. But in course of time he will find that the rifle rests quite naturally in his left hand and, if there is a hand-stop, stays in position without any muscular effort. The sling which at one time was disconcerting eventually becomes a help and is used whenever possible. It is an essential to rifles with extra heavy barrels, which cannot be held in comfort without its aid.

The art of aiming is to see the target in exactly the same position relative to the sights every time. The small-bore target man's sights make this comparatively easy, for the foresight is in the form of a ring and all that is necessary is to make sure that the aiming mark is centred perfectly in it. Once a man has achieved the ability to hold steadily he can do this, provided that he can get the shot off before eye fatigue sets in and the target fades or disappears.

When using a blade foresight, as with a military rifle, the aim is taken at the bottom of the bull (6 o'clock aim), with always the same amount of white between the aiming mark and the foresight. This is not so easy as using the ring foresight but much easier than using a bead, which has to rest just visible in the bottom of a V-notch open sight. This last is not at all good for target shooting.

Bad trigger release is one of the main causes of spoilt targets. The beginner tends to snatch at the trigger or, in bad cases, to flinch in anticipation of the explosion. The correct way to use

the trigger is to squeeze it slowly, adding pressure when, and only when, the sights are properly aligned. The exact moment of the explosion should not be known, for if it is expected it is anticipated, and anticipation will show as a shot badly placed on the target.

When the shot has gone the recoil throws the sights off the mark, but the shooter should continue to hold on until the barrel of the rifle falls back and the sights are once more in line. This "following through" is essential to good shooting.

Finally, having fired his shot the shooter should know if he has done anything wrong and should "call the shot", *i.e.* state where it has gone before looking through the telescope to find if he is right.

The elements of target shooting are best taught by a good coach. Anyone of reasonable intelligence and health who is sufficiently keen can with practice achieve "marksman" standard after a moderate period of coaching. Some men can teach themselves. Higher proficiency is attained with more practice, greater attention to detail, finding the causes of one's own faults, and the experience and assurance that come from shooting on strange ranges at open meetings.

In game shooting the premier requirement is getting in a sufficiently accurate shot while the animal is still within sight or within range. Speed without haste is essential, and allowance has to be made ahead of the direction in which the animal is moving. The rifle is brought up deliberately—not slid up—the butt being raised and pulled back into the shoulder so as not to catch on the clothing. This movement should not be hurried, although speed comes with time. The expert shot fires on the first aim almost at the instant that the butt touches the shoulder. The tyro should attempt to reduce the time he takes between the rifle coming up and the release of the shot.

When shooting at moving game the distance ahead of the target at which to shoot has to be estimated, although this in time becomes automatic. The rifle is swung through in the direction in which the animal is moving and the shot taken when it is just the right amount ahead. This swing must be continued for if it is not the shot is almost certain to be behind the mark. This is of the utmost importance.

Countrymen get plenty of practice at running rats and rabbits

with air-gun or rifle. But most townsmen do not have this opportunity to gain proficiency at moving targets. Deficiency of natural moving targets can be offset to some extent by dry-shooting practice. An American writer suggested aiming at the radiator caps of passing cars (making sure, of course, that you are not observed). Following his suggestion I found that by snapping an empty rifle at express trains that pass some three hundred yards from my house I greatly improved my running target scores. It was not careless snapping: each shot was aimed and called in quick time, and even doubles were fired, *i.e.* the rifle was snapped, the bolt operated and another aim taken as quickly as possible.

Another game that gives practice in getting off shots without delay is to hang a small tin can on a long string from a tree or post and keep it in motion, using an air-gun or air-pistol. When doing this the natural tendency is to wait until the tin has got to the end of its swing and take a quick shot while it is motionless. If this tendency is not resisted, no skill likely to be of value in the field or at the moving targets at Bisley will be acquired.

Ten or twenty shots a day at moving targets is usually sufficient. Practice should not be continued if the shooter becomes tired and inaccurate in his aim.

In the earlier chapters of this book differences of powder charge, and of weight and type of bullet, were discussed in relation to types of game to be shot. There are also different kinds of rifle according to the class of shooting.

A rifle designed and built for small-bore target shooting only is a heavy and often ugly weapon. It has no comfortable balance in the hands: on the contrary, the weight is distributed throughout the length of the weapon. This is advantageous in target shooting because the heavy barrel and more or less even distribution of weight reduces dither and minimizes the adverse effects of irregularities of hold and trigger pull. As the rifle has to be carried to and from the range only, and the shooter can rest before shooting, there is no need to limit its weight on account of portability. Thus the tendency has been for the weight of target rifles to increase progressively with the years, and rifles weighing from 13 to 15 lb. are now not uncommon.

There is some advantage in using a heavy rifle for long-distance vermin or shore shooting, when accurate aim is essential.

But this degree of accuracy is not necessary for all types of game shooting. It is impracticable in the off-hand position and when shooting at a moving target, and the heavy target rifle is too ponderous to carry for long distances across country.

For these good reasons the sporting rifle is made lighter, and the weight is concentrated between the hands of the shooter, so that the weapon has a comfortable balance and can be swung round, or up and down, to be quickly brought on to the mark. By the sacrifice of a few pounds weight it is made easily portable, and at the loss of a little potential accuracy the real chances of hitting live game are increased.

A. G. Banks, in his *A.G.'s Book of the Rifle*, wrote:

> ". . . when you come across beautifully made and finished and highly expensive 'streamline' models with 'shotgun balance', and weighing 5, 6, or 7 lb., beware. They look lovely: they are lovely to handle and play with in the gun-room. And that is the best place to leave them.
>
> You want the most massive weapon you can comfortably carry about."

This no doubt held true for a target marksman of Bank's high standard; but the advantages of the heavy barrel can be over-stressed. With a heavy target rifle a moderate marksman can hit a threepenny piece ten times out of ten at twenty-five yards range: whereas with a light sporting rifle he might require his aiming mark to be a halfpenny, or even a penny, to achieve the same standard. But as the vital parts of a rabbit or even a rat or stoat are larger than a penny, what does that matter?

It is quite possible to learn how to use a light rifle for accurate target shooting. I find that I can shoot to as good a target average at one hundred yards with my Brno Hornet, which without the telescopic sight weighs about 6 lb., as I can with my B.S.A. 12/15.

Some time back I went to the range with a master shot, taking my Brno with me, while he brought a B.S.A. International with extra heavy barrel. We fired some groups with our own rifles and then changed over. We found that while I could not shoot as well as he with the heavy rifle, he could not shoot as well as I with the sporter. But I made a better group with the sporter than I could with the target rifle.

The exact fit of a rifle to the shooter is of not so great importance as that of a shotgun. This is evident from the Bisley competitions, most of which are with service rifles either as issued or with certain modifications which do not include any fitting or alterations to the exterior of the stock. The service rifle does not fit anyone very well, for the comb of the butt is too low to be ideal for shooting in the prone position: nevertheless the experts achieve great accuracy at all ranges.

But there *is* advantage in fitting a rifle to the individual. In small-bore target shooting, alterations of the woodwork are permitted, and many competitors make modifications of a minor character such as lengthening the butt or fitting a hand-stop on the fore-end, while some completely re-stock their rifles to their liking.

Of most importance to the target rifleman are the length from trigger to butt plate, from trigger to hand-stop on the fore-end, and the position of the eye in relation to the sights when the cheek rests naturally against the butt. The shooter in time finds just what is best after making adjustments. He may later modify his adjustment if his style alters.

The cheek should rest naturally and steadily against the butt, and the eye should be in line with the sights. If this is not the case, the butt must either be built up by fitting a cheek piece or shaved down until the ideal form has been found. The alteration must, of course, take into account the variations of the position of the eye when shooting at different ranges or in different shooting positions.

The form of the butt most suitable for the prone position is not the best for off-hand or shooting when standing. Rifles intended mainly for shooting prone have a high comb and comparatively long stock. The shooter tends to move his eye forward towards the sights, and some target riflemen feel that they are in the right position when the nose is just in contact with the thumb of the right hand. But when shooting in the off-hand position the head should not be thrust forward. A stock with more bend, a lower comb and shorter butt is better, particularly for shots taken quickly.

As the position of the eye is related to the sights, rifles are normally made with stocks that will fit the average shooter when using the rifle in the position for which it is intended and

with the sights initially supplied. The provision of new sights will alter these adjustments. Telescopic sights, which bring the line of sight higher than iron sights, require a higher comb, so that a cheek piece has to be fitted. Without it a rifle which was comfortable with its original sights feels strange and unstable—the butt falling too low on the cheek or chin when the eye is in line. It is queer how little account many gunmakers seem to take of this fact. When visiting gunmakers' shops I have on several occasions picked up a rifle fitted with a telescopic sight, or built for use with one, and found the fit appalling, although the average rifle with iron sights usually fits me reasonably well.

In the adjusting of sights of sporting rifles an open-air range of appropriate length is obviously necessary. This presents no difficulty to members of clubs having the use of service rifle ranges. Occasionally, however, a rifleman or pistolman having the space available wants to fit up a private practice or testing range, and in this connection some warning should be given in matters of safety.

An outdoor range should be orientated in a northerly direction so that shooting will never be into the sun. At the butts end a bank should be raised to a height of fifteen feet by piling up earth against a framework of timbers. The bank should be of considerable thickness at the level of the target and extend laterally a good ten feet beyond the outer targets. The ground between firing point and target should be carefully cleared of all stones that might cause ricochets.

Even the smallest rimfire cartridge is capable of penetrating a thick wooden plank. Thick baulks of timber such as old railway sleepers will usually stop a single ·22, but several shots concentrated on one spot, as occurs in target practice, will quickly bore a hole through timber six or more inches thick. For this reason, while timber can be used as target supports, the bullet-stop proper should be a solid bank of earth or box containing earth. Timber is not recommended on air-gun ranges, for the pellets bounce off it and may come whining back towards the shooter. Steel plate is better.

Steel plates used as bullet-stops on small-bore target ranges should be sloped downwards at an angle of 45 degrees to deflect the bullet into a tray of sand or sawdust. They should be at

least ¼-inch thick to withstand concentrated fire on one spot. They should also be free from marked irregularities that might cause fragments of lead to ricochet back to the firing point.

The danger of ricochet must always be kept in mind when constructing indoor ranges. If a bullet is accidentally released so that it misses the bullet-trap, not much harm will be caused if it squarely hits a brick wall beyond. The bullet will simply break up and the pieces fly out sideways at a small angle with the surface of the wall: they will not come back to the firing point. But if the bullet-trap were so placed in the corner of a building that a badly placed bullet could hit the side wall at an angle of about 45 degrees and ricochet on to the opposite wall, it could come back to the shooter at a dangerous velocity. A similar danger arises if a range is constructed in a room that has reinforced concrete or steel beams below the ceiling. All possibilities of ricochet should be studied, bearing in mind that when a bullet breaks up on hitting a wall or an iron plate it by no means becomes harmless. It is usually smashed into very small pieces which continue for a short distance at a velocity sufficient to cause painful penetration of flesh.

Plate XII. "Muzzle loader."

Plate XIII. Holster for Webley ·22 Target Revolver: Holster for Webley Target Pistol: Shoulder holster: Military holster for ·455 revolver: Simple holster of folded and stitched leather. Home-made belt to take Hornet cartridges.

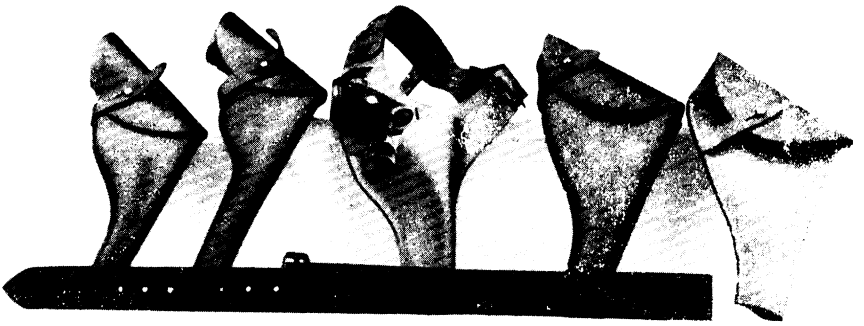


Plate XIV. "Black powder, cap and ball."

Plate XV. View through telescopic sight.

Chapter 12

The evening-dress boys—Need for practice—Technique of pistol shooting—Semi-automatic pistols—Revolvers—Pistols of present-day make—Buying a pistol

THE secretary of the club told me that the boys from the Special Branch of Scotland Yard had been down to compete with the pistol. "You know—the 'evening-dress' boys," he said. "I scouted round to get together a pistol team, but didn't think of you, because you hadn't been along for some time."

I didn't know just what he meant by the Special Branch or the evening-dress boys. The first term suggested the counter-spy business; the second, those fellows who go to West End clubs to deal with the current form of vice.

Whichever they were I was sorry not to have been present. It would have been interesting to see the police performing with automatic and revolver, particularly as they did well. One of them began with a ninety-three at twenty yards. But I wasn't invited and it was my own fault. It was one of the penalties of not putting in regular practice at the club. But I am a bad club-member. I am far more interested in experimenting with firearms than in competitive shooting and the winning of trophies. And that I do not always show up on club nights does not mean that I am not getting "dry-shooting" practice every day. Furthermore I burn a lot of ammunition at fixed and moving targets on a nearby open-air range that I visit alone. But whatever I do myself, I say to beginners: follow my precept and not my example. Practise assiduously, practise, and practise again, for practice is the secret of good shooting, particularly with pistols.

A good shot shoots every day, or at least several times a week. If circumstances do not permit of practice with a loaded arm, he will content himself with dry-shooting. Whatever the form the practice takes it must be with complete concentration of mind and hand, for it is *concentration* which brings consistent skill.

The technique of pistol shooting has changed considerably from what it was earlier in the century, yet there is far from complete agreement amongst the experts as to how the pistol should be held. It is generally conceded that the grip should be firm, for a tight hold on the butt is necessary to prevent pressure on the trigger from deflecting the aim. This is particularly true of double-action shooting with a revolver. The trigger must be pressed just as steadily as in rifle shooting—in fact, with even greater care, if this is possible. The pressure should be *straight back*, not to one side or another.

The pistol should be gripped as high as possible, that part of the hand between the first finger and thumb being well to the top of the grip. (Some revolvers have a nasty habit of pinching the skin between the finger and thumb when the hammer comes back, if the hand is held too high.) Some experts in double-action shooting recommend that the revolver be turned a little to the right in the hand: others say that all pistols should be held straight. Probably it is best to learn by experience which particular hold suits your style. The size and strength of your hand will determine to some extent what hold to adopt with any particular pistol. Remember all pistols do not behave alike and must be held according to their peculiarities.

While much is said of shooting from the hip and of snap shots taken without using the sights, consistent accuracy can only be achieved by properly aligning the sights. Even in very rapid shooting the sights must be aligned on the target. The expert does this in a minimum of time, getting the shot away by an even pressure of the trigger at just the right moment, without any suggestion of yanking at the trigger as he comes on aim. In deliberate target shooting, the pistol is brought up a little above the target and brought down again, the sights aligned and steadied while the shot is fired.

No one can hold a pistol perfectly steady; it always wavers to some extent, but by dint of practice the amount of movement can be reduced. There is a moment when the swing is at its minimum, and it is then that the shot should be got off easily, without jerk or snatch. The shot should be released within ten seconds of the pistol being raised, or the hand will begin to waver. If he does not steady on the target within this time, the shooter

should bring his hand down and rest for a while before coming up and having another try.

When commencing deliberate shooting at a target, the pistol should be taken in the left hand and *placed* in the right hand in the exact position which has become familiar and found satisfactory. The grip should then not be altered; the pistol should not be put down until all the shots have been fired and the target completed. If you put the gun down while you reload or pause to use a spotting telescope, every change of grip will show in the shots grouped on the card.

The method in rapid shooting is similar, except, of course, that speed is increased. The shots have to be taken in limited time, sometimes very limited, but still aim has to be taken and each shot got away while the sights are in line. Skill at rapid shooting comes after deliberate shooting has been mastered, and is attained by hard practice at increasing speeds but with no less care in taking aim and letting the shot go.

Several factors contribute to inaccuracy in pistol shooting. The inaccuracy of the man who, having no training or practice, misses the target completely is mainly due to snatching at the trigger sufficiently hard to pull the sights out of line. Hold is important because a good hold counteracts the inaccuracies caused by imperfect trigger squeezing. It also influences the recoil of the pistol and therefore the direction in which the bullet leaves the muzzle. If the grip is low on the butt, the pistol kicks higher than it would otherwise and the shot flies high. If it is high the shot flies low. Similarly, differences of hold can make the bullets group to the left or to the right of the bull. If you want to see the effect of this, experiment with an air-pistol. You will be surprised how many *inches* difference on the target at ten yards result from a quite moderate change of hold.

Another cause of inaccuracy is the slight but continuous dither of the sights that comes from the impossibility of keeping the hand perfectly steady. Gripping too tightly increases dither. Movement from the elbow is negligible, but movement of the arm about the shoulder causes a swing which, while slower than the dither of the wrist, makes a much more obvious and disconcerting movement of the sights on the target.

Finally, there is the movement of the body as a whole due to the unsteadiness of legs and ankles. It is quite impossible to

stand perfectly motionless and, whether using pistol or rifle in the off-hand position, the slow swing of the body must show on the target. By standing with the feet wide apart, movement from left to right can be reduced, but the backward and forward swing remains. If you stand square to the target, the up-and-down swing causes the sights to rise up and down on the target, and the error will show as the stringing of the shots in a vertical line. If you turn sideways to the target and shoot looking over your right shoulder in the old-time duelling style, the shots will tend to string in a line from left to right. The error is reduced to a minimum if the body is turned at an angle of 45 degrees to the target, when the shots will tend to spread from 7 o'clock to 1 o'clock, but should form a closer group than with either of the other stances.

On taking up your position at the firing point close your unloaded pistol, then, closing your eyes, bring the pistol up. If when you open your eyes again the pistol is not in line with the target, correct the line by *moving your feet*, and repeat the process until the pistol comes up on to the target naturally. You are then ready to shoot and can load, but *for safety keep the barrel in line with the target*, and do not move your feet or alter your grip. As you align the sights, let your unoccupied hand relax or rest in the trouser pocket. Then hold your breath with the lungs fairly full, and when the sights are making their least movement on point of aim squeeze off the shot. After the shot has gone do not immediately come down, but wait until the sights have come into line again. This habit assists in ensuring a steady let-off. Then, before looking through the spotting telescope, "call the shot".

Pistols are of limited power, and are not suitable for use against big game. The old ·455 revolver had a muzzle velocity of 600 feet per second but fired a heavy 265-grain bullet. Its momentum of impact was somewhat more than one-third of that of the ·303 rifle. The ·38, which has taken its place, fires a bullet of 200 grains at about the same velocity. The ·22 rimfire "rapid" cartridge has a greater muzzle *energy* than the ·38 revolver cartridge.

Pistols are classed as single-shot, revolvers and automatics. In the last instance they are more correctly semi-automatic, as the term automatic is strictly applied to weapons which go on

shooting for as long as the trigger is held. The great majority of "automatic" pistols are only "self-loading", and the trigger has to be pulled for each shot fired, but there are exceptions.

Roger Marsh, an American expert, informed me after I had referred to the Mauser 1912 as being one of a very few fully automatic hand guns:

> "The Mauser 1913 is but one of many. Patterned after it are the Astra 903, the Super Axul and, among others, at least two types of the Royale, one of which has a heavy flanged barrel and a hydraulic rate-control and buffer mechanism built into the grip. These were Spanish; another product of the same country was the Star Model MD, patterned after the Colt-Browning 1914 pistol, available in a variety of calibers, fitted with a holster stock and adapted to machine fire. The French Union firm made a blowback pocket pistol fitted for full auto-fire. One version of this Union pistol could use a 40-round horseshoe-shaped magazine. While this arm was designed to handle the ·32 AP, a later arm under the same mark was made for several more powerful calibers and was patterned after the 1911—it, too, could fire full-auto. I must add that the old faithful Lüger was converted for full-auto fire on occasion."

On the face of it this sounds a formidable list, but when one considers the numerous designs of pistols that have been developed it is really an insignificant minority. Anyhow, as far as the civilian pistolman is concerned, fully automatic pistols do not matter, for they are "prohibited weapons" for which, in Britain, the police have no power to issue certificates.

Heavy semi-automatic pistols work on one or other of the recoil systems: ·22 pistols are usually of the blowback type. There are many variations of detail and performance. Generally speaking, semi-automatics are easy to clean, and parts can be replaced without difficulty. They are, however, apart from certain exceptions, not so reliable as revolvers. Among the exceptions are the Colt designs, in particular the U.S.A. military model. Unfortunately English semi-automatics are not at present being made because the market has been killed by the Firearms Acts.

Among the curiosities of semi-automatic weapons is the

automatic revolver—a revolver so arranged that the recoil rotated the cylinder and cocked the hammer. The best known of this type is the Webley-Fosbery, which was originally made in the service calibre of ·455. There must be plenty of these about, for the N.R.A. rules for the Bisley meeting still mention this weapon by name.

Revolvers fall into two classes: "single-action" and "double-action". Single-action revolvers have to be cocked by pulling back the hammer, then fired by pulling the trigger. The action of pulling back the hammer rotates the cylinder, bringing the next cartridge into line. Double-action revolvers are fired by a long pull on the trigger, which causes the hammer to rise, rotating the cylinder, and finally releases the hammer to fire the round. Most, but not all, modern revolvers can be used both single- and double-action. Single-action target shooting is essentially a sport, but double-action shooting is practical shooting for use in war or emergency, and is much favoured by some target experts.

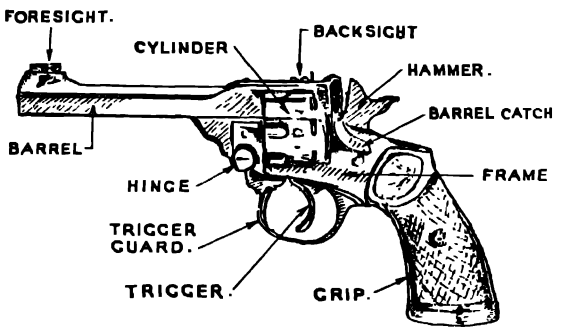


FIG. 14. The Component Parts of a Hinged-frame Revolver.

Revolvers are also classed as "hinged frame" and "solid frame". The hinged-frame type breaks downwards when a latch is depressed and instantly ejects its cartridges. In the solid frame the cylinder swings out laterally. The solid frame is usual in modern Colt and Smith & Wesson revolvers, but Webley & Scott adhere to the hinged-frame design.

The Webley Mark IV in ·38 and ·32 calibres has now replaced the old ·455 in British police and military services. Webley also make a Mark IV ·22 rimfire target revolver and a Mark IV

pocket revolver, the last in ·38 and ·32 calibres. All these revolvers are similar in main principles. All have hinged frames, and should the pistol not be closed properly it is prevented from firing by the hammer coming into contact with the barrel catch before it can strike the cartridge.

Apart from calibre, the only noticeable differences between the military model and the rimfire target revolver are in the sights, the length of barrel, and the fact that the former has a ring for the attachment of a lanyard. The military revolver has a rounded foresight that will not get caught up if the revolver is drawn quickly, and a fixed backsight mounted in the barrel catch, but target sights with lateral adjustment are available. The target revolver has a blade foresight sharply upstanding so as to give a clear outline no matter how the light may fall on it, and a square-notch backsight with lockable screw adjustments for both elevation and windage. The military model is made with either 4-inch or 5-inch barrel. The ·22 target model has a 6-inch barrel and is rather heavier. The Mark IV pocket model has a 3-inch barrel and an overall length of 7 inches. It has a much smaller grip than the military and target models. A safety is fitted at a small extra cost. An engraved, gold-plated presentation model with mother-of-pearl grips is made to this pattern.

All these models are capable of being fired single- or double-action as required. They have cylinders which can be removed for cleaning purposes. The cylinder is mounted with minute accuracy on a hollow axis (through which passes the extractor) and rotates with remarkable smoothness. The hammer of the loose-nose type is firmly held from contact with the cartridge except when the trigger is pressed.

The foreign pistols on the British market at the time of writing are mostly semi-automatics. These include the Italian "Beretta", the Spanish "Star", the French "Unique" and the Belgian "Browning".

The mechanism of a revolver requires such accuracy of workmanship, particularly in the cylinder and the parts in contact with it, that its manufacture can be entrusted only to the most skilled craftsmen. But because the gunsmiths know their work, the weapons they produce are consistently reliable and continue so over a long period of years. Nevertheless a revolver can

come to the end of the space of its useful life, and this should be borne in mind when buying in the second-hand market. More important still to bear in mind is that it may have been neglected, grossly misused or its moving parts tampered with by its owners in the past. A close examination of any second-hand weapon is always time well spent.

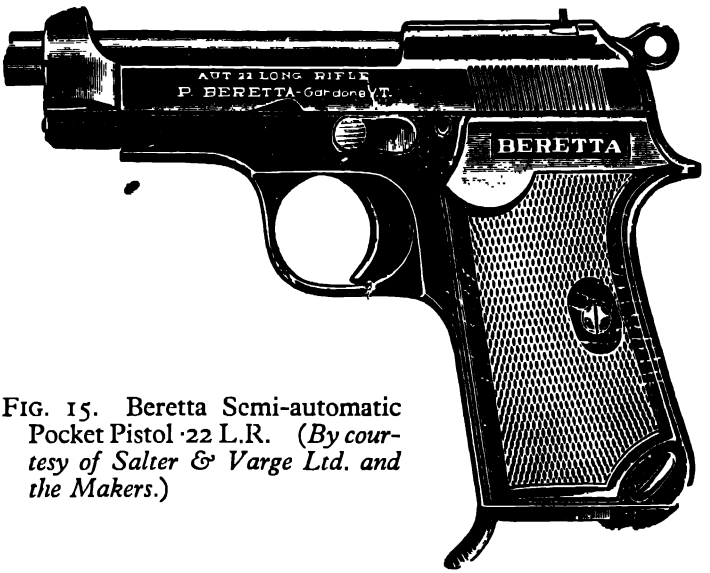


FIG. 15. Beretta Semi-automatic Pocket Pistol ·22 L.R. (*By courtesy of Salter & Varge Ltd. and the Makers.*)

If it has not already been done, first clean the barrel and chambers in the usual way and wipe out all oil. Then inspect; if possible from the breech end, Looking for the same faults and make the same tests on the barrel as you would for a rifle. The chambers of the cylinder should be free from any visible fault such as pitting or roughness, as it can be very difficult to eject six empty cases at once if the chambers are rough or overlarge. Next, close the gun and test the cylinder for play in a backwards and forwards direction. This should not be excessive, although some play is usually present. Hold the revolver up to the light and rotate the cylinder to ascertain if there is excessive space between the cylinder and the barrel: there must be a clearance but it should be small and the same for each chamber. Next, test the cylinder for rotary movement when the hammer is cocked. This again should be slight. But when the trigger is

held firmly back ready for firing there should be no movement at all, and every chamber should be exactly in line with the barrel.

There are special testing rods made for testing the accuracy of alignment of chamber with barrel. Even slightly bad alignment can cause inaccuracy of shooting, and will take shavings of lead off the bullets, which fragments other shooters or onlookers may receive in the face. Very bad alignment can be dangerous.

FIG. 16. "Unique" Mod. 51 Semi-automatic Pocket Pistol ·22 L.R. (*By courtesy of L. Le Personne & Co. Ltd.*)

The alignment of a hinged-frame revolver can be tested by pulling the trigger hard back after gently lowering the hammer. Then with great care open the weapon, making sure that in so doing you do not rotate the cylinder or permit it to rotate under the influence of any part of the mechanism. On inspection from the breech end the chamber should then be exactly in line. Each chamber should be tested in turn.

The rotation of the cylinder by pulling the trigger should be tested with the barrel pointing upwards, not level. If it is held

level, the weight of the pawl can make the mechanism work even though the spring has lost its strength. The spring of the pawl should be tested by pressing on it with the finger when the revolver is open. The circular ratchet on which the pawl acts should be sharp and free from dents or other damage. The cylinder-retaining catch at the bottom of the frame should be tested to make sure that its spring is in order.

The hammer and firing pin, if any, and the hole through which it acts should be examined carefully for corrosion and pitting. The firing pin, when the hammer is down, should protrude just sufficiently to indent the primer of the cartridge but not to hit the cylinder. It is, of course, desirable to fire a cylinder-full of rounds, for then extraction can be tested and the impression on the cartridge inspected. Any fault as to length of firing pin or strength of mainspring will also become evident.

The examination of automatic pistols is not so straightforward. There are tests that can be made which will indicate the possibility of faults, but malfunctions often occur as a result of minute imperfections or adjustments which no test other than shooting a fair quantity of ammunition will bring to light. It is therefore desirable, when buying an automatic, not only to examine the parts but to test by firing a good number of rounds of ammunition, including cartridges of different makes. Components to be tested and examined specially are the barrel and all safety devices incorporated in the mechanism. The lips of the magazine should be carefully examined; and also the disconnector, which prevents the gun from firing like a machine-gun.

Air-rifles and pistols are not without interest to marksmen for, although they are less accurate than firearms and not as deadly against game and vermin, they can save a lot of money in cartridges. They have the added advantage of being comparatively safe to use in localities where a real firearm could be dangerous.

Old-time air-rifles such as the one owned and used by John Peel (celebrated in song) worked on a principle different from that employed at present. Air was pumped into a spherical vessel about the size of a cricket ball that hung on the underside of the action, and was released on pressing the trigger. These rifles sometimes blew up.

Modern air-rifles and pistols are cocked by compressing a

strong spring or springs by moving a lever or by bending down the barrel. The trigger releases the spring, which drives a piston into a cylinder, compressing the air, until the pressure is sufficient to drive the pellet into the lead and thence out of the barrel.

When air is compressed heat is developed, and if the heat is sufficient and there is much oil in the cylinder, an explosion could be caused, the oil being fired and consumed as it is in a Diesel engine. As a protection against this contingency, special low flash-point oils are sold for lubricating air-guns. It was this type of explosion that sometimes blew up the old-time air-rifles. Air-rifles or pistols that have pistons with leather cup

FIG. 17. Walther Target Air-pistol. (*By courtesy of Salter & Varge Ltd. and the Makers.*)

washers should not be lubricated with mineral oil as this rots the leather. But a suitable mineral oil can be used for weapons with metal pistons and rings.

The motion of the piston before the air is compressed causes air-guns, particularly pistols, to recoil either upwards or downwards, according to the design, before the pellet leaves the barrel. This makes accurate shooting much more difficult than with a real firearm. This disadvantage is largely obviated in the design of the Walther Target Air-pistol, which has a piston of very short stroke driven by two springs acting more or less vertically in the grip instead of horizontally under the barrel.

This German pistol, in calibre ·177, has an 8-inch rifled barrel, an overall length of 12·2 inches and a weight of 40·6 oz. It is designed specifically for target shooting on the lines of the Walther Olympic Pistol, and has a grip and thumb rest which

helps to give a consistent hold. It is claimed to shoot a 1-inch group at 20 to 25 feet range. The backsight has micrometer adjustment for windage and elevation, and three interchangeable fore- and backsights are provided with each pistol. It is very easy to shoot with this pistol.

Chapter 13

Leather goods—A hunting sling without metal parts—A home-made cartridge belt—Pistol holsters—A rifle bag

ENTHUSIASTS in all classes of sport can derive much pleasure from the purchase of first-class equipment. Even those not initiated into the game can appreciate the high quality of materials and workmanship that is employed in the making of such goods. There is also considerable enjoyment in making one's own equipment, particularly if one can by skilful design and judicious choice of materials do better than the professional manufacturer. To take one instance; slings made to be used with sporting rifles are often not suitable for their purpose. They have metal parts that rattle and which, if they get the chance, will chafe polished woodwork and mar checkering. Sometimes the quality of leather used is not what it might be. For these reasons I make my own slings more or less on the following lines.

The strap should be in one piece about 6 feet long cut by a harness-maker from the best harness leather, and finished without buckles or perforations. Lay it rough side up, below the rifle. Then take the fore-end of the strap and, turning it up and back towards the butt end pass it through the fore-end attachment, smooth side of the leather up, and draw it through. Then turn it down and forward to bring it into contact with the "standing part" of the strap, and so complete the loop. Next take the other end of the sling and pass it through the butt attachment, bringing it back also to the standing part. (See Fig. 18.)

When you have the sling arranged as you think correctly, tie it with soft string, and get down to see if it fits when you are in the prone position. When you have got it just right make the permanent connections by punching the leather with a proper leather punch and lacing the parts together with raw-hide or brown-leather thongs.

Now take the sling off the rifle and liberally apply neat's-foot

oil (no other), and thoroughly work the strap through your hands to take all the stiffness out of it. If the leather is good, the oil will give it a warm-brown colour. When all the oil has soaked in, wipe the surface of the strap to remove the whitish deposit that has been left behind.

Now put the sling back on the rifle. Pass the laces through the holes, draw tight and tie any ornamental knot that takes your fancy, leaving a couple of inches loose-end of lace in Wild West fashion. Next, make a keeper of a few turns of thong to keep the parts together when not in use.

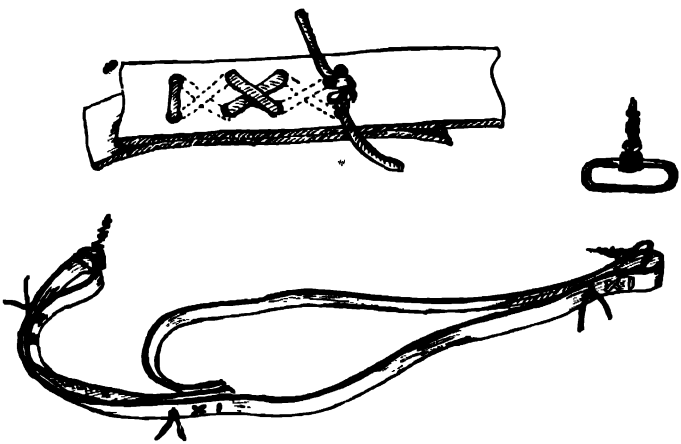


FIG. 18. Home-made Hunting Sling.

Note that the loop is on the top side, not hanging down as is usually illustrated. To use the sling pull the loop down and to the left, and put your arm through. Rotate your hand in a clockwise direction round the strap and take hold of the fore-end of the stock. This puts the twist on the sling that prevents the edge of the strap from cutting into the back of your hand, and does away with the necessity for any sling-swivel.

For this type of sling the ideal attachments are those which consist of merely a flat metal loop and screws, with nothing that can flap about and scratch the stock. (See Fig. 18.)

A cartridge belt for metallic ammunition, or any cartridges for that matter, is quite easy to make, and in my opinion looks better than many you can buy. It is certainly a lot cheaper.

An army-surplus leather belt of the kind that ordinary privates use is the best basis. These, in new condition, can be bought in any of the shops that deal in such things. Next get a sound leather strap of adequate length (to be found by experiment), 1¼ inches wide, and of similar colour. Test the strap's reaction to the application of neat's-foot oil; a strap which goes grey or dirty-looking when oiled will never look well. The only other materials needed are a small four-sided leather-worker's awl, a triangular-bladed sailmaker's needle, a sailmaker's palm, some good twine and a hard boxwood ruler of the schoolboy type.

Soak the leather strap in water until it is soft; cut one end off clean with a sharp knife and shave it down on the rough side. Place this end on the belt in the position in which you intend to start, make four holes in a vertical line with the awl through strap and belt. Then, with the needle and sailmaker's palm, stitch the strap to the belt through the holes with ordinary backwards and forwards stitches.

Having done this, place a fired cartridge-case on the belt and under the strap; press the strap tightly round it. Press heavily with the edge of the ruler to get the strap tight and then pierce four more holes on the line left by the pressure of the ruler. Carry on with the same length of thread and stitch tightly in position.

Withdraw the cartridge and repeat the operation so as to make as many cartridge pockets as the belt will accommodate. Do not make the last stitches until you have neatly trimmed off the end of the strap and thinned it down as you did the first end.

Now, return the stitches, working back through all the stitch holes in the opposite direction, so that the work is double-stitched from end to end. Finally, secure the two loose ends of twine.

The belt, when finished, should be left to dry with empty cartridge-cases in all the holes, so that the work dries to shape. When the belt is dry it can be coloured by applying a fairly lavish coat, or a number of coats, of neat's-foot oil, and wiped to remove the white deposit. A belt made this way is shown in Plate XIII.

In the United States, where they have a history of wildness and woolliness and are sentimental about it, some of the lads like their equipment to follow the pattern of the early days. To

cater for this taste, pistols are still made to the external contours of the old frontier pistol and with single-action mechanism, albeit the calibre is ·22 and the innards up to the best modern standards. Likewise their holsters follow similar trends, most of them bent on assisting the guy who wants to be quick on the draw. Among these are the ordinary belt holster, made of leather, having no flap, and cut away to expose the trigger; and spring holsters, which grip the pistol in such a way that it can be wrenched out forwards instead of lifted out.

These no doubt are all right in their place, but they have no place this side of the Atlantic. Here, the majority of holsters are made for members of the armed forces, and as soldiers need to carry their weapons in all weathers their holsters have to be protective. Thus a flap comes right over the top and is secured in position by a strap which fits over a brass stud.

I recommend this type of holster for those who want to protect their pistol or revolver when it is being carried in a bag with other equipment. This holster completely covers the metal-work, protects the sights, and goes quite a long way towards excluding dust and dirt. The leather for this type of holster must be very thick, like that of the sole of a shoe. It should not be soft and should not be lined.

Do not keep your pistol in the holster when it is not in use, for leather and metal do not get on well together, as you may have observed if you have ever left rounds of ammunition in a cartridge belt for some weeks. However, your weapon will come to no harm if it is left in the holster after first being wrapped in a piece of silk that has had a good dose of Young's "·303" oil rubbed into it.

A shoulder holster is not designed to protect a pistol but merely to carry it inconspicuously. The Americans, who probably originated the design, are inclined to deride it, because it does not permit rapid drawing of a gun. But it is not without its uses. If you don't like carrying things and prefer to keep your hands free when walking or cycling down to the range, the shoulder holster serves an excellent purpose.

A shoulder holster is rather better than a special pocket made in a shooting coat. I have tried the latter more than once but always found that a pistol of target size weighs down the coat uncomfortably, so that you cannot forget its presence. I made a

Plate XVI. Pistol shooting at Bisley.

Plate XVII. (*Top*). Webley Single Shot .22 R.F. Target Pistol.
(*Bottom*). Webley "Mark IV" Revolver.

reasonably good pocket out of American cloth sewn in well under the armpit of an old jacket. Later, I found it difficult to persuade a tailor that a leather pistol pocket was a necessary part of a new suit. He eventually put it in, but used such a soft leather that it was always a job to get the pistol out.

One final word to the shooting man. Take your firearm certificate with you so as to minimize delay or trouble should anyone question your right to be in possession of a firearm. And because certificates are flimsy paper things which easily become ragged if carried in the pocket, make a leather case to hold it, together with your gun or game licence and club membership card.

I have tried several kinds of rifle bag. The ordinary kind made of brown canvas reinforced with leather at the muzzle and over the backsight is satisfactory for carrying target rifles to and from the range. The canvas is waterproof even in heavy rain, and wears well. But this kind of bag gives very little protection to the rifle against knocks. I have had a backsight damaged, and a stock dented through the canvas of such a bag, though the canvas was undamaged. Accordingly I have had made a sheepskin-lined bag that fits two of my telescope-sighted sporting rifles. It is not a stock article but can be obtained from London gunmakers. The bag is made of brown canvas with leather-bound edges and leather reinforcement on the outside at the muzzle and over the action. Inside the canvas is sheepskin with the close shorn wool on and facing inwards. The bag is cut so as to fit fairly freely. This gives a good deal more protection against knocks and avoids all possibility of chafing woodwork or metal.

Chapter 14

An old catalogue—Gun cabinets—Cleaning

I HAVE an old stores catalogue dated twenty years ago. It is a thick book and lists, with prices, everything a country gentleman might want. It is interesting to look at, but depressing when one compares the prices in it against those current at the present time.

This catalogue is the only place I have seen proper gun cabinets described and illustrated. They are like bookcases with glass doors behind which six guns can be placed in the rack. Underneath are cupboards with drawers suspended above a space for boxes of ammunition.

Such a cabinet is the thing to have if you can afford it: and presumably you can if your collection of firearms includes three pairs of best guns or their equivalent in rifles. But in these days there are not so many wealthy people about. There must be many like myself who have a fair-sized battery of not too costly weapons but have not the money to spend on proper cabinets to keep them in.

A friend of mine keeps his target rifle, which he uses two or three times a week, in the hall cupboard among the overcoats, hats and umbrellas. Not the best place to keep a rifle, but he keeps it in good working order and knocks up some creditable scores.

I keep my weapons in the library, together with a little ammunition. But I would not say that the humidity of the library is quite right; it is on the damp side. Nevertheless I keep my guns and powder dry, for I have found that the ideal armoury is a steel office cabinet which I converted.

I took out all the shelves but two, one at the top and the other to the bottom, tipping the lower shelf so that a rifle is canted backwards when it stands on its butt-plate. Below this shelf was just enough space to store cans of oil and tins of ammunition.

Then with a mortice chisel I cut recesses into a piece of hardwood to take the butts of the various rifles, each recess cut truly

to shape and to such depth fore and aft that the rifle it was intended to take would rest comfortably at the angle that would bring the barrel against a notched support.

From a piece of 1-inch by 2-inch oak I cut notches for the rifle barrels to rest in. I smoothed it with sandpaper, oiled it with raw linseed oil, and fixed it across the cabinet so that it was just below the foresight. Above I arranged the upper shelf as high as possible to avoid knocking the muzzles against it when lifting them out. On this shelf I kept cartridge blocks, elbow pads, gloves, cleaning rags and anything else not conveniently stored in specially made accommodation.

On the back wall of the cabinet behind the rifles I fixed a mahogany shelf to take Young's Cleaner, Rangoon Oil, and a large box of flannelette patches. On the side walls I fixed metal shelves filched from the kitchen cabinet to hold odd boxes of ammunition, spare magazines, a pair of dark glasses and a pull-through, with a small oil-can and a few flannelette patches for everyday use.

Elsewhere I screwed cuphooks of the square-ended type from which to suspend cleaning rods, and sockets for screw-drivers, drifts and other essential gunsmith's tools. Below these hang my home-made trigger-testing weights.

Smokeless powder and ammunition keep best if stored at a temperature of about 70° F. and a relative humidity of 70 per cent. Overheated and dry conditions are injurious to powder, and damp is harmful to priming compositions and the paper of shotgun cartridges. Smokeless powders for reloading are most easily harmed by exposure to sunlight.

Main stocks of ammunition I keep in press-tins so as to prevent any change of moisture content. At one time I feared that the Hornet cartridge might go temporarily off the market, so I laid in about a thousand rounds and kept this more or less replaced as I used it. A thousand rounds of Hornet last a long time, so I take good care of it.

In America most cartridges have percussion caps containing non-corrosive composition that does not rust the barrel, but this composition does not protect the barrel to the same extent as non-corrosive rimfire cartridges. Most English central-fire cartridges have primers containing potassium chlorate. These primers store well, are very reliable and perform well with the

powders used. But when potassium chlorate burns it produces potassium chloride, which is deposited in the barrel and, collecting water from the air, very quickly sets up rusting. Even coating the barrel with oil is no complete protection against this. Potassium chloride, however, is very soluble in water and can be completely removed by pouring water through the barrel. Although hot water is not essential for this purpose, it is better than cold water because it dries out more quickly after the barrel has been partially dried by pushing through flannel patches.

Special funnels with spouts tipped with an old cartridge-case so as exactly to fit the chamber are made for the washing of barrels. The spouts are formed at an angle that makes it possible for the end to be put into the chamber without the wide part of the funnel catching on any other part of the rifle. A whole kettleful of water should be used to make sure of doing the job properly.

Unless you have been told, or have learnt by hard experience, you can forget that boiling water quickly makes a barrel too hot to hold. Also there is the possibility of accidentally pouring hot water on your hand. To avoid these dangers make a gadget out of wood to hold the barrel safely.

After hot-water treatment the barrel should be thoroughly dried out with a series of dry patches, and then left upright and open at both ends so that while the barrel is hot a convection of warm air is drawn through it, evaporating any remaining moisture. Finally the barrel should be oiled with a patch saturated in gun oil or Young's "·303" cleaner. This oil should be removed with a clean patch before the weapon is used again, for, although a thin layer of oil is not likely to cause an accident, it will make the first shot go wild. I would also add the warning that new rifles and pistols received from the makers, or rifles and pistols that have been put away for a long time, are coated with thick grease. If a shot were fired through a barrel in this condition, a burst would be the almost certain result.

The ·22 Hornet cartridge and Holland & Holland's ·240 Apex are non-corrosive central-fire cartridges of English make. These will not cause rusting of the barrel. But the proportion of cap composition to powder is not sufficient for the composition to protect the barrel against corrosion by the moisture in the air. Consequently, while there is no need to use hot water for cleaning after these cartridges, the barrel should be cleaned and oiled.

To clean after using Hornet ammunition I wrap a patch soaked with gun oil round the jag and push it through from the breech end till the tip just shows at the muzzle, then draw it back, turn the patch over to its clean side, and push it through again. Then I use dry patches, both sides as before, until they come out nearly clean. Finally I oil up with two or three strokes of the rod and a patch soaked in Young's cleaner. I clean and oil the chamber separately, for the chamber, being larger than the barrel, is not cleaned by merely pushing patches through but needs to be rubbed round. This can be done by wrapping a patch round a brush or mop of sufficient size.

After oiling it is advisable to leave the rifle muzzle downwards until the Young's cleaner has dried out, for this is a substance of a soapy nature with a volatile component. It thickens on drying and should not be allowed to run into the mechanism of the lock. On the other hand, the thickening on drying is advantageous, for it gives a much more permanent coat to the barrel than would a plain oil.

Some people were nervous about not cleaning when they were first introduced to non-corrosive rimfire ammunition. And there is still a belief that using different brands of non-corrosive ammunition may cause reactions between the residues, resulting in "after-rusting". I cannot guarantee that this argument is wrong, for who can tell what substance someone may decide to include in their powder. I can only quote my own experience, which is that I have used English, American and Finnish ·22 cartridges, one type after another, without cleaning and have never had any trouble.

Non-corrosive rimfire ammunition does not cause rusting and is said to give better protection to the barrel than oil. Whether this is true or not I do not know, but, again speaking from personal experience, I have put away rimfire rifles and left them in the gun cupboard for months, some protected with Rangoon oil, some with Young's "·303" Cleaner, and some with the residue left by a few rounds of ammunition. But as I have never had any rusting in any of the barrels, I cannot say which method of protection is the most effective.

You should, however, be careful to make sure that every round you fire is non-corrosive. There is quite a lot of antiquated ammunition still about, and just one round of it is enough to make cleaning with hot water advisable.

The extent to which you do clean, or rather find cleaning necessary, when using non-corrosive rimfire ammunition depends on the rifle and the use to which it is put. Target men are inclined to clean as a precaution before shooting an important match card because they want to be sure that the barrel is clear of lead. They clean with patches, starting first with an oily patch, then dry ones. By this means any leading will be visible as greyish streaks. Where leading is present it should be scrubbed out with a bronze wire brush.

Leading depends on the degree of smoothness of the barrel. I have seldom detected it in my ·22 rimfire rifles, so presumably they must be smooth. But sometimes a new rifle very quickly accumulates a deposit of lead, and after it has been cleaned starts to accumulate it again in the same places. When this happens the rifle should go back to the maker for relapping.

I rarely clean the barrels of my sporting ·22's and pistols, but regularly clean the chambers of the pistols, and particularly the revolver, so that extraction will not become difficult. I also clean the front of the cylinder of the revolver and, more occasionally, the frame, and wipe with an oily wash-leather any parts where residue might collect.

Before putting a firearm away in the gun cupboard it is just as well to give all the metal parts a wipe over with an oily wash-leather, not merely to reduce the risk of rust from condensed moisture but to remove any finger-prints that might leave rust marks. On one occasion I was shooting in hot weather; and although my hands usually do not perspire much, apparently they did this time, for the next day I found a line of rusty finger-prints on the barrel. Fortunately a good rub with woollen rag followed by a touch of oil completely obliterated the marks.

When cleaning or oiling it is hard to keep gun oil or lubricating oil from getting on the woodwork or sling. But do not let it stop there: mineral oil is injurious to wood and leather. The only oil to use on the stock is vegetable oil, preferably raw linseed oil, a reasonable application of which helps to give protection from damp, but too much darkens the woodwork and spoils the appearance. Neat's-foot oil is the only oil I ever use on leather, and then only in moderation.

GLOSSARY

ACTION. Mechanism by which breech of breech-loading rifle or gun is closed.

ACTION BODY. Part of rifle or gun which contains action and into which barrel is screwed.

ATER-RUSTING. Rusting of bore of barrel due to potassium chloride residue from cap composition.

AIMING MARK. That part of the target which is a different colour from the remainder, *e.g.* black on a white background.

ANVIL. Metal support in or under percussion cap on which cap composition is crushed by hammer or firing pin.

APERTURE SIGHT. An "iron" backsight which is placed close to the eye and consists of a small circular hole.

AUTOMATIC. *Strictly*, a weapon which continues to fire for as long as trigger is held. *Loosely*, a semi-automatic or self-loading weapon which fires and reloads chamber every time trigger is pressed.

BACK-ACTION SIDE LOCK. Action of shotgun or double-barrelled rifle in which mechanism of lock is to the rear of bar.

BACKSIGHT. The rear of a pair of metallic sights.

BALL-BURNISHING. A proprietary method of removing tool marks from bore of rifle by pushing steel balls through.

BALLISTIC COEFFICIENT. Sectional density divided by coefficient of form.

BALLISTIC PENDULUM. Pendulum into which bullets are fired to ascertain momentum.

BAR. Forward projection below standing breech of shotgun or double-barrelled rifle to which barrels are locked when action is closed.

BAR-ACTION SIDE LOCK. Action of shotgun or double-barrelled rifle in which mechanism of lock is accommodated in the side of bar.

BARLEYCORN.—Oblate spherical bead that serves as foresight on shotgun.

BARREL BAND. Band surrounding barrel and securing it to fore-end of stock.

BARREL FLIP. Bending of rifle barrel at the moment of discharge, causing deflection of bullet.

BARREL LATCH. Latch which holds closed breech of hinged-frame revolver.

BASE OF BULLET. Rear face of bullet.

BEAD FORESIGHT. Foresight which appears as a circular bead on a stalk when viewed from the rear but which in fact is often a tapered cylinder supported on a blade.

BEAVER-TAIL FORE-END. Broad fore-end shaped like the tail of a beaver.

BELLMOUTHING. Wearing of muzzle of rifle as a result of careless cleaning with pull-through or rod.

BELTED CARTRIDGE. Rimless cartridge having a belt near the head to prevent it from going too far into chamber.

BEND. Amount of drop of gunstock below the line of the top of barrel.

BENT. Notch in which sear engages when piece is cocked

BLACK POWDER. Gunpowder containing potassium nitrate, sulphur and charcoal.

BLADE FORESIGHT. Foresight consisting of square-topped blade or post.

BLANK AMMUNITION. Cartridges containing cap composition, powder and wad but no bullet or shot.

BLANKS. Steel forgings from which barrels are made: roughly shaped pieces of wood from which stocks are made. *See* BLANK AMMUNITION.

BLOW-BACK. Blowing back of cartridge and breech block in an accident. Also the principle of operation of some automatic and semi-automatic weapons.

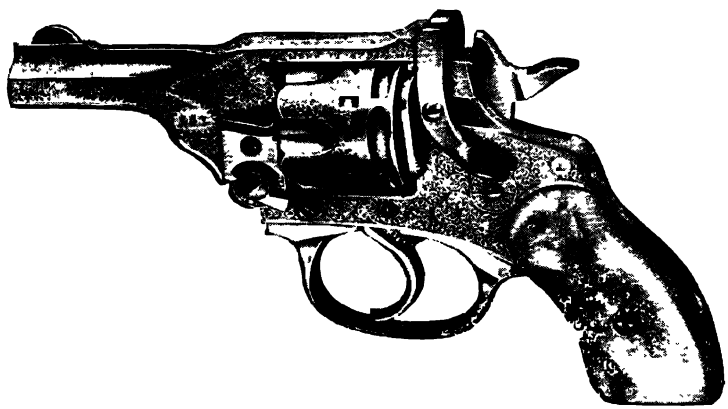
BLUEING. Controlled rusting of the parts of rifle to produce a blue or black colour.

BOAT-TAILED BULLET. Bullet which is tapered towards both ends so as to reduce the air resistance.

BOLT. Breech block of bolt-action rifle consisting of tube containing firing pin and mainspring; locking lugs; extractor and bolt handle by which it is operated.

BOLT ACTION. Action, as in Mauser, which incorporates bolt that closes breech and is held in position by lugs which engage when bolt or part of it is rotated.

BOLT LEVER. Lever on bolt action by which mechanism is operated.



Plates XVIII, XIX. Webley "Mark IV" Revolver, pocket mode and presentation model.

Plate XX.—"Mooching."

BORE. Internal diameter of barrel of rifled arm as measured between the tops of lands. Also, the size of shotgun or old-time large-bore rifle given in terms of the number of lead balls of the size that barrel will take that go to the pound, *e.g.* barrel of 12-bore gun will pass lead ball that weighs $\frac{1}{12}$ lb. *See* CALIBRE.

BOX LOCK. Action of shotgun or double-barrelled rifle in which mechanism of lock is housed centrally in bar, not at the side. Also known as Anson and Deeley action.

BOX MAGAZINE. Magazine of bolt-action rifle and various automatic and semi-automatic weapons in which cartridges lie side by side and are pressed by a spring laterally into action.

BREECH. Rear opening of barrel.

BREECH BLOCK. Bolt or block of metal that closes breech and holds cartridge in position.

BRIDGE. Part of action body of some types of bolt action, *e.g.* Mauser, which passes over the rear end of bolt.

BRISANCE. Shattering effect of a high explosive.

BROWNING. Controlled rusting of parts of rifle to produce a brown or black colour.

BULK POWDER. Smokeless powder occupying approximately similar space to black powder charge of equal strength.

BULLET CRACK. Noise produced by bullet travelling at or above the speed of sound.

BULLET TRAP. Any device for catching bullets and preventing ricochet after they have passed through target.

BULL'S-EYE. That part of target which denotes the highest score.

BUMP. Top rearmost corner of butt.

BUTT. Rear portion of stock of rifle or gun.

BUTT-PLATE. Metal, horn or plastic plate on that part of butt that rests against the shoulder.

CALIBRE. Diameter of bore measured in inches or millimetres according to country of origin. *See* BORE.

"CALLING THE SHOT". Stating where on target a shot has arrived as judged by any conscious error in shooting.

CANNELURE. Groove round bullet or cartridge-case.

CAP CHAMBER. Recess for percussion cap in base of central-fire cartridge.

CAP COMPOSITION. Explosive which fires on percussion and is used for igniting cartridge.

CARBINE. Short rifle originally for use by cavalry.

CAST OFF. Measure of the amount that butt of rifle or gun is set to the right of line of barrel as viewed from the rear.

CAST ON. Measure of the amount that butt of rifle or gun is set to the left of line of barrel as viewed from the rear.

CENTRAL-FIRE CARTRIDGE. Cartridge having percussion cap in centre of base.

CHAMBER. That part of barrel which is shaped to accommodate cartridge.

CHAMBERING TOOLS. Tools used when shaping chamber.

CHECKERING. Diagonal cuts to roughen surface.

CHEEK PIECE. Raised surface on butt to accommodate cheek.

COCK. To set hammer or striker ready for firing. Originally the term "cock" was used for hammer-like mechanism that held flint of an old-time gun.

COEFFICIENT OF FORM. Coefficient dependent on shape of ogive of bullet.

COMB OF BUTT. Top edge of butt.

COMPARATIVE MICROSCOPE. Forensic ballistician's microscope with two eye-pieces and so arranged that two bullets may be examined simultaneously and the images brought together in order that direct comparison may be made of striations.

CONE. Taper between chamber and barrel of smooth-bore gun.

CRIMP. An inward turn to the edge of cartridge-case, in particular when causing the edge to be folded or wavy.

CROSS PIN. Large pin on to which hook barrels of a shotgun or double-barrelled rifle.

CRUSHER. Small cylinder of lead or copper used in pressure gun for testing pressure developed by cartridge.

CYLINDER. Part of revolver that contains chambers.

DAMASCUS. Metal formerly used in barrel making and consisting of iron and steel wires twisted and welded together.

DENSE POWDER. Smokeless powder which occupies a small space when compared with an equal-powered charge of black powder.

DETONATE. To explode violently: also to cause a charge to explode violently by using a suitable primer.

DISC SHOOTING. Rapid-fire shooting at breakable discs nailed to targets.

DOLL'S-HEAD. Projection on top rib of double-barrelled gun or rifle arranged to fall into recess in top of action body and assist in holding action closed.

DOUBLE-BASE POWDER. Powder containing both nitrocellulose and nitroglycerine.

DRIFT. Lateral movement of bullet in direction of spin, *e.g.* a British service-rifle bullet that has a left-hand spin moves a measurable amount to the left when fired at long range.

DRY SHOOTING. Practising by aiming and snapping at targets without using ammunition.

EJECTOR. Mechanism that throws fired cartridge-case out of action. In some instances ejector is merely a small projection against which the base of cartridge strikes when pulled rearwards by extractor.

ELEVATION. Measure of vertical movement of backsight for any particular range of fire.

EMPTY MAGNIFICATION. Excessive magnification of a telescope that causes lack of definition.

EROSION. Wear of barrel close to chamber caused by powder gases.

EXIT PUPIL. Width of the band of light that is emitted by eye-piece of a telescopic sight.

EXTERIOR BALLISTICS. Study of the movement of projectiles through the air.

EXTERNAL LUBRICATION. Lubrication of bullet outside cartridge.

EXTRACTOR. Mechanism that pulls fired cartridge-case out of chamber.

EYE RELIEF. Distance between telescopic sight and eye when optimum view is obtained.

FACE OF ACTION. *See* STANDING BREECH.

FALLING-BLOCK. Breech block that moves downwards when breech is opened.

FANNING THE HAMMER. Firing revolver, that has had trigger mechanism removed, by holding it with one hand and stroking back hammer with the other.

FLATS. Flat surface of bar and barrel that come together when shotgun or double-barrelled rifle is closed.

FLOATING FORE-END. Fore-end which has no contact with barrel.

FOLLOW THROUGH. Retaining aim after shot has gone.

FORE-END. That part of stock which is forward of trigger guard.

FORESIGHT. Iron sight near muzzle of rifle or pistol.

FORESIGHT PROTECTOR. Fixed or movable guard to foresight.

FORESIGHT RAMP. Metal block sloping to rear and supporting foresight.

FOULING. Residue of burnt powder in barrel.

FRAME. That part of pistol into which mechanism is built.

FULL BORE. Service-rifle or service-pistol calibre.

FULL COCK. Position of hammer of hammer gun when ready for firing.

GAS ACTUATION. Actuation of automatic mechanism by means of gas that is drawn off at some point from barrel and acts on a piston in a cylinder.

GAUGE. Measurement of bore of shotgun or large-bore rifle in terms of the number of lead balls of that diameter that go to the pound, *e.g.* the bore of a 12-bore gun will pass a lead ball weighing $\frac{1}{12}$ lb. *See also* BORE and CALIBRE. Also instruments for measuring bore, head space, etc.

GILDING METAL. Copper alloy used for bullet jackets.

GRATICULE. Arrangement of cross wire, posts, etc. that indicate point of aim of telescopic sight.

GRIP. That part of pistol held in hand: also hand of a rifle.

GROOVES. Spiral cuts produced in rifling barrel.

HAIR-TRIGGER MECHANISM. Arrangement by which trigger can be set so that a slight touch will cause weapon to be discharged.

HALF-COCK. Position of hammer of hammer gun or rifle with nose just clear of base of cartridge. This is the "safe" position adopted by hammer on reloading.

HAMMER. Visible external part of gun, rifle or pistol that falls to fire cartridge.

HAMMERLESS EJECTOR. Shotgun or double-barrelled rifle with internal concealed hammers and which throws out fired cartridges.

HAND. Narrow part of gunstock which is held in the right hand.

HANDGUARD. Wooden covering to military rifle barrel to prevent soldier from burning his hand when barrel is hot.

HAND-STOP. Stop fixed to fore-end of target rifle to prevent left hand from slipping forward when sling is used.

HANG FIRE. Delayed discharge of cartridge.

HEAD OF CARTRIDGE. Base or that part of cartridge which is to the rear when cartridge is in chamber.

HEAD SPACE. Tolerance of distance between forward support of cartridge and face of breech block.

HEAT TREATMENT. Hardening treatment of suitable steel by chilling and tempering.

HEEL. *See* BUMP.

HEEL-PLATE. *See* BUTT-PLATE.

HINGED-FRAME REVOLVER. Revolver that is unloaded by pressing barrel-latch and bending down barrel.

HOLLOW-POINT BULLET. Bullet with recess in nose to facilitate expansion on impact.

HUNTING RIFLE. American term for rifle used for shooting game; equivalent of British sporting rifle.

INNER CARTON. Small dotted circle in centre of bull's-eye, used when judging ties.

INTERCEPTING SAFETY. Safety mechanism which comes between firing mechanism and cartridge to prevent discharge.

INTERIOR BALLISTICS. Study of the behaviour of powder and bullet inside barrel.

INTERNAL LUBRICATION. Lubrication of that part of bullet which is enclosed in cartridge-case.

"IN THE WHITE". State of parts of firearm prior to blueing or browning.

IRON SIGHTS. Rifle sights not containing a system of lenses.

JACKET. Gilding metal or cupro-nickel outer covering to lead bullet.

JAG. Roughened end-piece of cleaning rod made to hold patches or other cleaning materials.

JUMP. Upward movement of weapon on recoil.

KEYHOLE. Bullet which, owing to inadequate spin, hits target sideways-on is said to "keyhole".

KNOX FORM. *See* NOCK'S FORM.

KNUCKLE. Rounded end of bar through which cross bolt passes.

LAMINATED STEEL. A material formerly used in gun barrels consisting of steel and iron plate welded together and wound in the form of a spiral.

LANDS. Raised spaces between grooves of rifling.

LAP. A lead casting used with abrasive to smooth the bore of rifle: to use a lap in smoothing bore.

LARGE BORE. Rifle of large calibre (there is no universally recognized limit between large- and medium-bore). Burrard has given ·600 and over for large-bore; and John Taylor, ·450 and larger.

LEAD. The cone-shaped transition from smooth-bored throat of chamber to rifled barrel.

LEVER ACTION. Repeating rifle reloaded by lever.

LIGHTENING CUTS. External grooves in fore-end to reduce weight.

LOCK. Mechanism consisting of trigger, sear, bent, striker, etc., which fires cartridge or charge of a piece.

LUMP. Projection below barrels of shotgun or similar design of rifle by which barrels are secured to action.

MAGAZINE. Box or tube which contains cartridges in repeating weapon.

MAGAZINE SPRING. Spring in magazine which pushes cartridges into action.

MAGNUM. Rifle with a muzzle velocity of not less than 2,500 feet per second; or shotgun or revolver that takes unusually powerful cartridge.

MAINSPRING. Spring that moves hammer or striker.

MATCH RIFLE. Special design of rifle of service calibre used in competition at Bisley for the purpose of ascertaining the quality of ammunition. In America the term is used for any target rifle.

MEDIUM-BORE. Rifle of moderate calibre. There is no agreement on the upper and lower limits to which the term applies.

METALLIC CARTRIDGES. Cartridges for rifled arms consisting entirely of metal, *i.e.* not having paper cases.

MINIATURE RIFLE. Obsolescent term for ·22 rimfire rifle.

MIRAGE. Distortion of the sight line and of the image of the target due to rising hot air.

MISFIRE. Complete failure of cartridge to fire.

MUZZLE. Opening at front end of barrel from which bullet or shot is fired.

MUZZLE BLAST. Release of powder gases at muzzle.

MUZZLE BRAKE. Mechanism attached to muzzle to reduce jump or recoil.

MUZZLE ENERGY. Energy of bullet at muzzle.

MUZZLE VELOCITY. Velocity of bullet at muzzle.

NECKING DOWN. Modifying factory cartridge-cases for use with smaller calibre bullets.

NECK OF CARTRIDGE-CASE. Narrow part of case into which bullet is fitted.

NOCK'S FORM. Flat on top of reinforce of barrel used in manufacture as level surface to which sights, etc., are related.

OFF-HAND. Shooting in the standing position "off the hand", *i.e.* without support.

OGIVE. The arched curve of bullet nose.

OPEN SIGHTS. Iron sights consisting of blade or bead foresight and open-notched backsight.

OPTICAL SIGHTS. Sights containing lenses: in particular, sight consisting of two lenses only, one fixed to muzzle end of barrel and the other close to the eye of the shooter.

ORTHOPTIC. Spectacles or monocle made of card with a small hole to sharpen image of pistol sights.

PALM REST. Projection below fore-end of target rifle for use when shooting in the hip-rest position.

PARALLAX. Imperfect internal adjustment of telescopic sight that results in movement of reticle relative to target when the eye is moved laterally.

PATCH. Small piece of fabric wrapped round bullet of muzzle-loading rifle; metal jacket to base of bullet; piece of fabric used in cleaning barrel.

PATCHED BULLET. Bullet having jacket over base only.

PATRIDGE SIGHT. Pistol sight consisting of rectangular blade foresight and rectangular notch backsight.

PAWL. Spring-loaded component that engages with ratchet of revolver cylinder.

PEEP SIGHT. *See* APERTURE SIGHT.

PERCUSSION CAP. Copper or brass cap containing composition which ignites on percussion, used for igniting powder charges in muzzle-loading weapons, or by incorporation in cartridges in breech-loading weapons.

PISTOL. Short-barrelled firearm held in one hand.

PISTOL GRIP. Projection below hand of rifle shaped like grip of pistol.

PISTOL GRIF CAP. Ornamental end to pistol grip usually containing trap for storage of spare foresight beads.

PITCH OF GUN. Angle that barrel makes with face of butt-plate as measured by taking the distance between muzzle and the edge of a square, one limb of which is placed on toe and bump of butt and the other against the rear top surface of barrel. This is sometimes referred to as the "stand" because it can be roughly measured by standing gun against the wall with butt resting squarely on the floor.

PITCH OF RIFLING. Angle that rifling forms with a line drawn parallel with bore.

PLATFORM OF MAGAZINE. Plate in box magazine on which cartridges rest.

POINT-BLANK. Range at which sights do not have to be raised above zero.

POSSIBLE. Highest possible score in target shooting.

PRESSURE BARREL. Special gun made for testing the pressure developed by cartridges.

PRIMER. *See* PERCUSSION CAP.

PROGRESSIVE POWDER. Propellant powder designed to burn at a comparatively regular, not reducing, rate.

PROOF MARK. Mark made by Proof House to indicate that arm has been proved.

PROPELLANT. Explosive used in guns for propelling bullets, shot or shells.

PULL-THROUGH. Barrel-cleaning device consisting of a cord with a weight at one end and a loop for attaching cleaning patches at the other.

QUARTER-MINUTE CLICKS. Adjustment of backsight for elevation or windage in sharply defined clicks, each representing movement of sight line by one-quarter minute of angle.

REBOUND LOCK. Lock so arranged that hammer rebounds clear of cartridge after firing.

RECEIVER. *See* ACTION BODY.

RECOIL. Backward movement of weapon on firing.

REINFORCE. Thickened portion of barrel adjacent to the point of junction with action body.

REPEATER. Arm with magazine which is reloaded by operation of slide, bolt or lever.

REST SHOOTING. Shooting with the aid of a support for the barrel.

RETICLE. Arrangement of cross-wires, posts, etc., that indicate point of aim of telescopic sight.

REVOLVER. Repeating pistol having revolving cylinder that contains chambers.

RICOCHET. Lateral deflection of bullet on striking an object or water.

RIFLING. Grooves (now always spiral) cut in bore of rifled arm.

RIMFIRE CARTRIDGE. Cartridge which has cap composition in projecting rim at base.

RIMLESS CARTRIDGE. Cartridge which, in place of a projecting flange, has a cannelure into which extractor fits.

RING BULGE. Swelling on barrel caused by stoppage.

RING FORESIGHT. Foresight consisting of a ring in which target is centred.

ROOK AND RABBIT RIFLE. Obsolescent central-fire low-velocity rifle used for rook and rabbit shooting.

ROUND. Complete fixed round cartridge consisting of cap, cartridge-case, charge and bullet.

RUSSETING. Finishing by rust process to a rich-brown colour.

SAFETY. Device to prevent accidental discharge: also referred to as "safe" and "safety catch".

SALOON RIFLE OR PISTOL. Obsolescent small-bore short-range weapon usually of smooth bore, not rifled.

SCHNOBBLE. Rounded downward projection at tip of fore-end.

SEAR. Lever which engages with bent of tumbler, or cocking piece of bolt action, when action is cocked.

SEASON CRACKING. Cracking of brass cartridge-cases with age.

SECTIONAL DENSITY. Bullet weight in pounds divided by square of diameter in inches.

SEMI-AUTOMATIC. Weapon which fires and reloads on trigger being pressed but does not fire again until trigger has been released and pressed again.

SEMI-FLOATING FORE-END. Fore-end fixed to barrel at one point but not in contact with it elsewhere.

SHOOTING FROM HIP. Pistol shooting from level of waist without using sights.

SHOULDERS OF CARTRIDGE. Curved portion of cartridge-case between main body of case and neck.

SIDE PLATES. External plates of side locks.

SILENCER. Device to reduce noise of muzzle blast.

SILHOUETTE TARGET. Man-shaped pistol target arranged to appear and disappear.

SINGLE-SHOT. Weapon that has no magazine and has to be loaded by hand for each shot fired.

SINGLE-TRIGGER MECHANISM. Mechanism by which one trigger is used to fire each barrel of double-barrelled rifle or gun in turn.

SIX O'CLOCK AIM. Aim at bottom of circular aiming mark with sights adjusted to bring shots to centre.

SLIDE. Part of semi-automatic pistol which is drawn back to cock action.

SLIDE ACTION. Repeating rifle or gun operated by sliding fore-end.

SLING. Leather or webbing for carrying rifle, or to assist steady hold when shooting.

SLING-EYE. Eye fixed to barrel or stock for attachment of sling.

SLING-SWIVEL. Freely swivelling attachment at the end of sling.

SMALL-BORE. Rifle of small calibre, particularly ·22 rimfire.

SMOKELESS POWDER. Propellant powder consisting of nitrocellulose and other compounds.

SNAPPING. Pressing trigger of cocked, but not loaded, weapon.

SOFT-NOSED BULLET. Jacketed bullet that has lead exposed at nose to facilitate expansion.

SOLID BULLET. Bullet not hollow-nosed.

SOLID-FRAME REVOLVER. Revolver which has a frame that is not hinged. Cylinder is loaded by being swung out laterally or, in old patterns, while left in position.

SPILL BORING. Method used in accurately boring gun barrel in manufacture.

SPORTING RIFLE. Rifle used for shooting game. In America the term "hunting rifle" is used with this meaning.

STAND. *See* PITCH.

STANDING BREECH. Vertical face of action body that supports base of cartridge in shotgun action.

STOCK. Wooden (or, rarely, plastic) structure to which barrel and action are fixed.

STRAP. Steel projection at rear of action body by which butt is fixed.

STRIKER. Pin struck by tumbler or hammer and, in turn, striking percussion cap; pin attached to cocking piece in bolt action and which strikes percussion cap.

STUB IRON. Type of wrought iron at one time used for gun barrels.

TAIL OF SLING. Strap connecting from loop of American sling to rear sling-eye.

TANG. *See* STRAP.

TARGET RIFLE. Rifle designed specifically for target shooting, particularly with ·22 rimfire ammunition.

TELESCOPIC SIGHT. Sight in form of a terrestrial telescope and containing reticle which indicates aim.

TEN-RING. Ring in the aiming mark of a small-bore target indicating highest score.

THROAT. Smooth part of bore between chamber and rifling.

TOE. Lower rearmost corner of butt.

TOP EXTENSION. Projection of top rib of shotgun engaging with top of standing breech.

TRAJECTORY. Course of a projectile through the air.

TRAP. Spring-loaded lid in pistol-grip cap or butt giving access to storage space.

TRIGGER. Lever pressed to release sear.

TRIGGER GUARD. Curved guard to protect trigger from accidental discharge.

TRIGGER SPRING. Spring which returns trigger to original position.

TUBE MAGAZINE. Magazine in form of a tube located below barrel in which cartridges are stored end-to-end.

TUMBLER. Concealed hammer of hammerless gun.

TUNNEL FORESIGHT. Foresight enclosed in tube to shade it from the light.

VARMINT RIFLE. American rifle taking high-velocity central-fire ·22 ammunition and used for shooting vermin at long range.

VIEW MARK. Mark made by Proof House to indicate that a weapon has been viewed.

WAD. Disc of felt, card or other material placed between powder and shot or over shot in cartridge.

WILDCAT AMMUNITION. Non-standard American ammunition made by conversion of factory cartridges.

WIND DOPING. Estimating and making allowance for the effect of wind.

WIND GAUGE. Lateral adjustment of sights.

X-RING. *See* INNER CARTON.

YAW. Spiral course caused by precession of spinning bullet.

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